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CRYPTOPHIDION ANNAMENSE, A NEW GENUS AND SPECIES OF CRYPTOZOIC SNAKE FROM VIETNAM (REPTILIA: SERPENTES)

VAN WALLACH AND GWILYM S. JONES
Center for Vertebrate Studies, Department of Biology, Northeastern University Boston, Massachusetts 02115, U.S.A.

ABSTRACT: The Vietnamese sharp-nosed snake, *Cryptophidion annamense*, is a new cryptozoic genus and species representing Category VI of Greenwell (1985). It is described from Quang Nam-Da Nang Province, central Vietnam, based upon three color slides taken of the type specimen in 1968. The holotype is presumed lost as we have not been able to trace its disposition. This snake exhibits several unusual features, such as a depressed snout with pointed rostrum, greatly reduced concave nasal shields separated from the rostral, large preorbital shield in place of a loreal and preocular, large temporal-like postoculars, a temporolabial shield, and a short tail. No snake is known with this unusual morphology from Southeast Asia, and no other genus of snakes in the world compares in all respects with this new taxon. Its relationships are therefore highly speculative. After comparison with all sharp-nosed burrowers and snakes sharing characteristics associated with a subterranean lifestyle, it is concluded that it shares the most similarities with *Myersophis* of the Philippines, *Lycophidion* of Africa, and *Emmochliophis* of Ecuador. Although probably a member of the Colubridae, the Atractaspididae, Elapidae, and Hydrophiidae cannot be excluded as possibilities.

INTRODUCTION

Cryptozoology is the science of hidden animals. Interestingly enough, the list of at least 110 cryptozoic species compiled from more than 20,000 references by Heuvelmans (1987) contains only terrestrial, aquatic and marine-inhabiting organisms, and, of those listed, nearly 75 percent are mammals, and more than 60 percent are terrestrial (Heuvelmans 1983, 1987). This is not surprising since large terrestrial animals are more readily visible to humans than smaller animals or those inhabiting aquatic or subterranean habitats. A number of cryptozoic serpents have been reported in the literature, but these are generally very large boids or pythonids. Heuvelmans (1987) mentioned one freshwater and five or six large terrestrial snakes from tropical regions around the world, while Dethier and Dethier-Sakamoto (1988) reported on a small terrestrial viperid, the *tzuchinoko*, from Japan.

The most likely place to find a cryptozoic serpent is in a cryptic habitat

like the underground environment. However, truly subterranean or fossorial species are the most difficult types of snakes to find and collect, and are the most poorly represented ecological group in museum collections. Southeast Asia in general, and Vietnam in particular, are geographic regions that remain relatively unexplored ophiologically. With the exception of Thailand, where the snake fauna is fairly well known and active research continues (Taylor 1965, Nutphand and Tumvipart 1982, Cox 1991), only a few works have appeared to supplement the classic study by Smith (1943) on India and Indochina, including Saint-Girons (1972), Kampuchea; Deuve (1970), Laos; and Campden-Main (1970), South Vietnam. The Annam highlands between 16°–19° N along the Laos-Vietnam border is an area where several new and unusual animal species have been recently discovered, such as a fish, a turtle, a monkey and an ungulate (Stone 1992, Dung et al. 1993).

During the Vietnam War, Senior Chief Petty Officer Calvin E. Snyder, USN, and Lt. Gwilym S. Jones, MSC, USNR, among others of the U.S. Naval Medical Research Unit No. 2, collected zoological specimens for eventual deposition in the Smithsonian Institution's National Museum of Natural History. Three poorly-focused photographic color slides taken of a snake collected west of Da Nang in 1968 are apparently the sole remaining evidence for the existence of a cryptozoic genus and species new to science. Attempts to trace the specimen at the National Museum of Natural History and other institutions with Asian collections have failed. As far as we can determine, the one and only known specimen is lost, apparently having never been deposited in a museum nor reported in the literature (Campden-Main 1970). Because of its uniqueness, it is felt that a description of the taxon is warranted in order to inform the scientific community of the existence of this snake, and in the hope that additional specimens may be collected—or perhaps discovered in a museum collection as misidentified material.

Since the original specimen cannot be located, and no additional specimens have been collected or reported in the 25 years since it was discovered, the taxon qualifies in a loose sense as being ethnoknown (Greenwell 1985). The native Vietnamese may be aware of the existence of this snake, but this cannot be verified or refuted at the present time. This serpent has certainly escaped the notice of the scientific community. Because the slides provide indisputable autoptical evidence documenting the existence of this ophidian, it is a cryptozoic taxon (Heuvelmans 1983, 1985). Since the type and only known specimen appears to be lost, it is cryptozoic in more than one sense of the word, and can best be classified under Category VI of Greenwell (1985), which contains "new taxa of known, extant forms for which no known organic evidence exists." It is worth noting that, while we cannot achieve the highest ideal of cryptozoology, "to describe an animal scientifically before it has been captured or collected" (Heuvelmans 1985), we are achieving a portion of that ideal by describing an animal for which there is no extant

organic evidence. The definition of cryptozoology by Heuvelmans (1985) can now be expanded to include unknown species of animals about which not only "some testimonial and circumstantial evidence is available" but also autoptical or material evidence.

The International Commission on Zoological Nomenclature (ICZN), in order to insure that the scientific name of every taxon is unique and distinct, has established a methodology for the naming of zoological taxa based upon a philosophy of stability and universality. The Code (ICZN 1985), utilizing the Principles of Binomial Nomenclature, Name-bearing Types, Coordination, Priority, Homonymy, and First Reviser, provides mandatory rules and advisory recommendations for the stabilization of zoological nomenclature. As illustrated by Article 61(a) of the Code, "each nominal taxon has, actually or potentially, its name-bearing type." Each family has a type genus, each genus has a type species, and every species has a type specimen (or type series). Although Recommendation 73A suggests that "an author who establishes a new nominal species-group taxon should clearly designate its holotype," it is not necessary to have a type specimen for the taxon to be named, and the lack of a type specimen in no way precludes a species' name from being valid. Article 73(a)(iv) of the Code, which treats the designation of an illustration of a specimen as the holotype as being equivalent to designation of the specimen illustrated, states that "the fact that the specimen cannot be traced does not of itself invalidate the designation."

It is not uncommon to have nominal or name-bearing species for which no types exist. Missing or lost types are usually connected with species described prior to 1850 whose types were either subsequently lost (or destroyed) or never preserved and deposited in a museum. At least 10 percent of all valid snake species are without their original type specimens today. Based upon a quick perusal of the approximately 2,700 extant snake species listed in a synopsis of living and extinct snake species (Wallach and Williams, in preparation), a conservative estimate of missing types is as follows: the types of 90 species are lost or destroyed; there are 30 species whose names are based solely on illustrations of the types; another 25 species have types that are lost and that now have neotypes designated; and there are 130 types listed as missing or unknown (hence possibly lost). This total of 275 missing or lost types does not include any of the types reportedly deposited in museums but which have not been searched for or located in recent times, many of which may be missing or lost.

The morphology of the head, venter and tail of this new snake strongly suggests that it is a burrowing form. Burrowing snakes have evolved different head shape profiles, both dorsally and laterally, in response to a secretive lifestyle, the two main types being blunt-headed and sharp-nosed. The lateral head profile in burrowers is often depressed in the region of the snout. The rostral shield at the tip of the snout may exhibit different shapes independently of the lateral head profile; it may be rounded, blunt, or pointed.

The following characters are associated with a secretive (subterranean or fossorial) lifestyle in snakes: (1) reduced head size with tapered head or snout; (2) loss of preorbital lateral head shields (loreal and/or preocular) with contact between prefrontal and supralabials; (3) reduction or loss of ocular shields; (4) loss of postorbital lateral head shields (one or more temporals) with contact between parietal and supralabials; (5) loss or fusion of dorsal head shields (internasals and/or prefrontals); (6) reduction in size of nasal shields; (7) separation of nasal or prenasal from rostral; (8) reduction in size of eyes; (9) reduction in number of supralabials to 4–6; (10) reduction in number of infralabials to 5–7; (11) reduction in number of longitudinal scale rows to 15 or fewer; (12) absence of posterior scale row reduction; (13) absence of keels or apical pits on dorsal scales; (14) reduction of overall size; (15) reduction of tail to less than 15 percent total length; and (16) reduction in number of subcaudals to less than 40 (Marx and Inger 1955, Inger and Marx 1965, Marx and Rabb 1972).

Materials and Methods

In attempting to determine the affinities of this snake, a search was made to identify the family and genus to which it belongs. As it is obviously a burrower, a comparison was made with all secretive snake genera—initially from Southeast Asia, but subsequently throughout the world—that exhibited any of the above characters, and especially a depressed head and laterally pointed rostrum. A total of 88 genera representing seven families were found to possess some or all of the above criteria: 27 genera of five families from Asia, 21 genera of three families from Africa and Madagascar, 14 genera of one family from Australia and the South Pacific, and 26 genera of two families from the New World. The search for this unknown snake's closest relative began with these 88 genera from seven families

Data on 26 characters that are recognizable from the slides of the holotype were compiled. Most are standard taxonomic characters such as head shields, segmental counts, and various proportions. A brief description of the characters listed in the tables follows. The taxonomic allocation is a code with each letter representing the family, subfamily, and tribe that the genus is considered to belong to, the Lampropeltini (CCLa) and Lycodontini (CCLy) requiring four letters for distinction. Meristic characters include the total number of ventrals (V), subcaudals (SC), supralabials (SL) and supralabials entering the orbit (SLO), infralabials (IL) and infralabials contacting the pregenials (IP), enlarged pairs of genials (G), preoculars (PR) and postoculars (PO), and primary (PT), secondary (ST) and tertiary (TT) temporals. Qualitative characters include whether the anal plate (A) is single or divided, the subcaudals (CT) are single or paired, the mental (M) contacts the pregenials, the nasal (N) is entire, semidivided or divided, the loreal (L) is present or absent, a temporolabial (TS) is present, the nasal (NN) is larger than the

nostril, the lateral shape of the rostral (RS) is rounded, blunt or pointed, the snout (LS) is depressed or not, and the color and/or pattern of the venter (VC).

Proportional ratios include the ventral proportion (VP), tail proportion (TP), eye proportion (EP), and snout-eye proportion (SE). Ventral proportion indicates whether the ventrals are narrower than the body, approximately equal to the body diameter, or greater than the body width. Tail proportion indicates what percentage of the total length the tail comprises. Eye shape in snakes is often not round, as the vertical diameter may be greater than or less than the horizontal diameter. Eye proportion is the vertical diameter of the eye divided by the depth of the head, measured from the frontal to the border of the upper lip. Snout-eye proportion is the snout length, measured from the snout tip to the anterior edge of the orbit, divided by the horizontal eye diameter, and indicates how many times the eye diameter is contained in the length of the snout.

The data utilized in this study were derived partly from the literature and partly from examination of specimens deposited in many museums, most notably the California Academy of Sciences (CAS), the Field Museum of Natural History (FMNH), and the Museum of Comparative Zoology (MCZ). Representatives of 85 of the 88 genera listed in the tables were examined by the senior author, the exceptions being *Emmochliophis, Pararhadinaea* and *Tetralepis*. Data summarized in the tables encompass, as much as possible, the entire range for a given genus, not merely the normal or modal values. Thus, occasional or rare values have been included to estimate the maximum possible extent of variation within a taxon, an important fact when comparing different organisms. General regional references relied upon for comparative data include Boulenger (1893, 1894, 1896), Bourret (1936), Broadley (1983), Cogger (1992), Cope (1900), Deraniyagala (1955), Deuve (1970), Ernst and Barbour (1989), Maki (1931), Pope (1935), Rooij (1917), Saint-Girons (1972), Smith (1943), Storr, Smith, and Johnstone (1986), Taylor (1965), Witte (1962), and Wright and Wright (1957).

Description

Due to its presumed cryptic habits and its geographic origin, this remarkable new taxon is named

Cryptophidion annamense, n. gen., n. sp.

Figs. 1–3

Holotype. The specimen, probably an adult female, which is the subject of three 35mm photographic color slides deposited in the slide collection of the MCZ Department of Herpetology, Harvard University. Since the holotype may or may not be extant, and is presently untraceable and presumed lost, we informally refer to the slides as iconotypes (Frizzell 1933).

The iconotypes include MCZ-K948 (Fig. 1a: lateral view of head), MCZ-K949 (Fig. 2a: lateral view of snout), and MCZ-K950 (Fig. 3: ventral view of body) respectively. None of the iconotypes are in perfect focus, but, fortunately, in K948 the posterior head is in focus while in K949 the snout region is in focus. A type slide is a name-bearing type that provides the objective standard of reference whereby the application of the name of a taxon can be determined. Furthermore, Article 72(c)(v) of the Code makes it clear that the holotype is the specimen upon which the slides are based, in this particular case the type having been lost before publication—rather than afterwards, as is true for approximately 10 percent of all snake species. As the new genus is monotypic, *C. annamense* automatically becomes the type species of *Cryptophidion.*

Type locality. West of Da Nang, Quang Nam-Da Nang Province, central Vietnam, ca. 16° N, 108° E. The type locality is presumably in the Annam Highlands. Collected in 1968 by an unknown collector, and preserved and photographed by Calvin E. Snyder.

Range. Central Vietnam. Known only from the iconotypes of the type specimen.

Etymology. The Greek *kryptos* (hidden or secret) refers to both the presumed subterranean existence of the snake and to its cryptozoic status with regard to the missing holotype. The Greek *ophidion* is a diminutive of *ophis* (snake or serpent). Thus, *Cryptophidion,* the gender of which is neuter, signifies a small hidden snake. The specific epithet *annamense* is derived from the name for the region of the type locality (Annam) up until the middle of the 20th century. *Cryptophidion annamense* is therefore the small hidden (literally and figuratively) central Vietnamese snake. It is proposed that the common name of *Cryptophidion annamense* be the Vietnamese sharp-nosed snake.

Diagnosis. Within Vietnam, *Cryptophidion* can be diagnosed solely by its pointed rostral in lateral view. *Cryptophidion* can be distinguished from all Asian snakes by the following suite of characters: depressed snout with laterally pointed rostral, eight supralabials, loreal absent, and undivided anal plate. *Cryptophidion* is separable from all other known snakes by the combination of depressed snout with laterally pointed rostral, enlarged preorbital shield, loreal absent, entire anal shield, and 172 ventrals.

Description. Although the iconotypes (MCZ-K948, K949, and K950) provide unequivocal evidence as to the uniqueness of *Cryptophidion,* a complete description cannot be provided at this time as the dorsum of the specimen is unknown, there being no photograph of the dorsal surface of the head or body. Characters that are presently unknown include the size and shape of the dorsal head shields, including possible fusion of shields, number of dorsal scale rows, presence or absence of apical pits and carination on costals, and dorsum coloration and/or pattern.

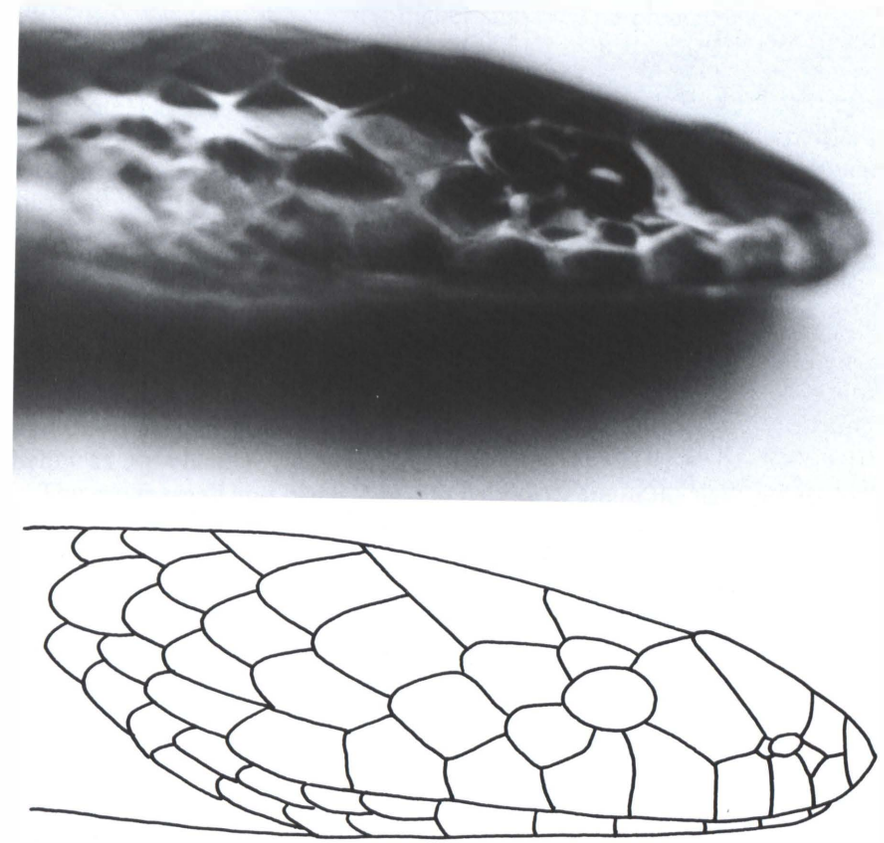

FIG. 1.—Lateral head of *Cryptophidion:* (a) slide MCZ-K948, (b) reconstructed outlines of head shields.

In lateral aspect, the snout is depressed with an obtusely pointed rostral that projects beyond the lower jaw (Fig. 1). Eight supralabials of approximately equal size border the upper lip: the three smallest are preocular supralabials (first to third), the two largest enter the orbit (fourth and fifth), and the three intermediate-sized are postocular supralabials (sixth to eighth). The superior borders of all supralabials have an inverted V-shaped aspect so that the shields above them are wedged between the upper portions of the labials. This zigzag pattern of all the labials is common in primitive

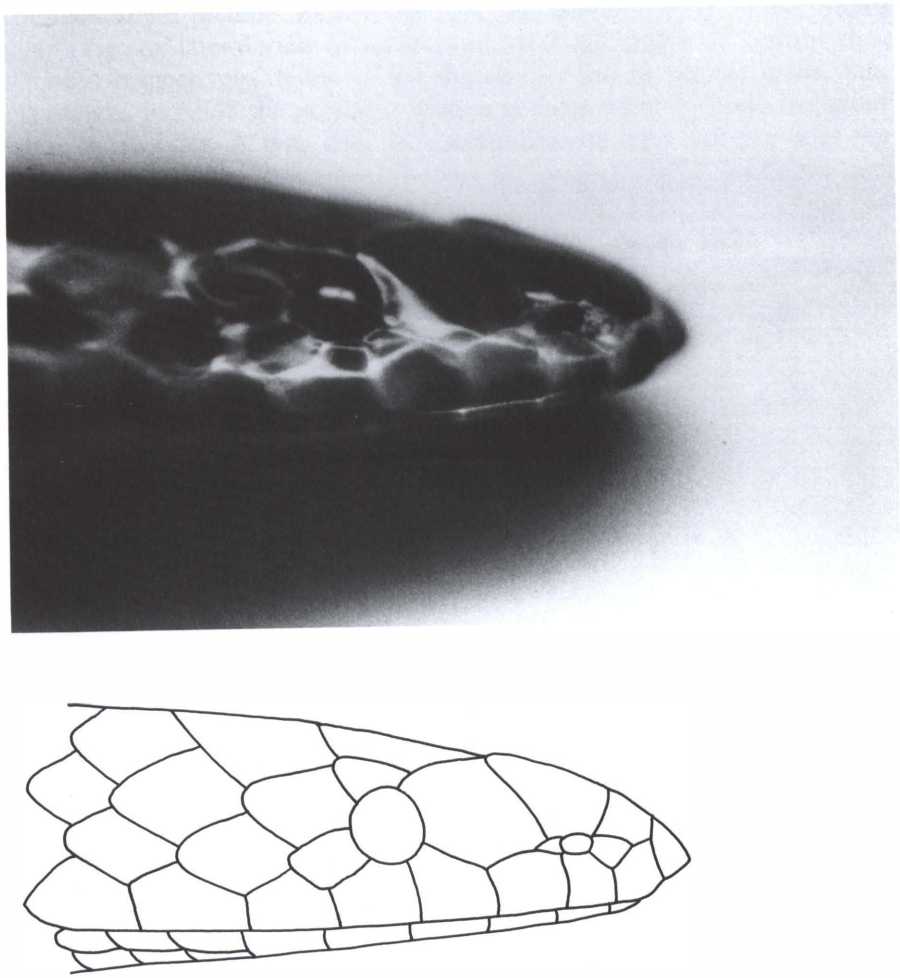

FIG. 2.—Lateral snout of *Cryptophidion:* (a) slide MCZ-K949, (b) reconstructed outlines of head shields.

snakes such as *Cylindrophis* and *Xenopeltis*; when occasionally present in higher snakes, it is usually only along the postocular supralabials.

The nasal shields are concave and greatly reduced in size (Fig. 2). A laterally directed oval nostril is situated medially in the nasal. The nasal is divided into a rectangular prenasal, equal to the nostril in size, and a tiny triangular postnasal, smaller than the nostril. A loreal shield (*sensu* Peters 1964) is absent, either lost or fused to the large quadrangular shield covering the dorsolateral region of the snout anterior to the orbit. This preorbital shield,

equal in length to half of the eye-snout distance, is in contact with the prefrontal and postnasal anteriorly, the frontal and supraocular posteriorly, and the third and fourth supralabials ventrally. Due to its position, the most likely homology of this shield is the preocular, although a preocular of such dimensions is unknown among higher snakes. The preocular of *Xenopeltis* and the prefrontal of *Cylindrophis* and the Uropeltidae resemble this shield in size and position. The likelihood of it corresponding to the loreal shield is remote, based upon its size and its curvature onto the dorsum of the head, but it could represent the fusion of an enlarged preocular and loreal. An even more remote possibility is that this shield represents a prefrontal or fused prefrontal-internasal that has been forced onto the lateral aspect of the snout as in *Xenocalamus,* possibly as a result of fusion with the preocular and/or loreal. However, two shields are clearly visible on the dorsum of the snout between this large shield and the rostral. They are interpreted as the prefrontal and internasal, but they could be fragmented shields as found in henophidians or even neomorphs. For purposes of discussion, since its homology is unknown, this enlarged shield will be termed a preorbital (based upon its position), but for comparative purposes it will be listed in the tables below as a preocular.

The eye is small and black, equal to 0.4 the depth of the head at the ocular level, with its diameter contained in the snout length 2.5 times. Although a pupil is not visible, it is assumed to be round based upon the supposed cryptozoic habits of the snake. The orbit is surrounded by six shields. In addition to the preorbital and the fourth and fifth supralabials, the shield bordering the eye dorsally appears to be a small supraocular. Only a faint indication of the medial longitudinal suture of that shield is discernible, so a remote possibility exists that a supraocular is absent and that an enlarged frontal borders the orbit. Two large shields, diamond-shaped with widths greater than depths and having rounded caudal apices, border the posterior edge of the orbit between the supraocular and supralabials; they are peculiar but, by definition, should be termed postoculars. Postoculars are normally deeper than wide, conform to the shape of the orbit, and are smaller than the eye. The superior shield, greater in size than the eye with a depth and width equal to that of the primary temporal, is larger than the inferior shield, which is approximately equal in size to the eye. Their size and configuration resemble the true temporals immediately posterior to them. In addition, they align anterodorsally-posteroventrally with the parallel axes of the true temporals. The V-shaped ventral margin of the lower shield is wedged between the fifth and sixth supralabials. Whether or not the latter shield should be termed a postocular or a subocular is equivocal, since the lower border of the orbit is at a level that bisects the shield in half (Peters 1964); for purposes of this study, it too will be referred to as a postocular.

The true temporals are large, diamond-shaped shields, arranged in oblique

rows extending anterodorsally to posteroventrally, with rounded apices with a formula of 1 + 2 + 3, resembling those of Lycophidion. The primary temporal is the most inferior, and its V-shaped ventral margin is wedged between the sixth and seventh supralabials, a condition in which the shield is termed the temporolabial scute in many elapids (McDowell 1967). It is excluded from contact with the parietal by the upper postocular, a rather unique condition as the anterior or upper primary temporal normally contacts the parietal in snakes. The uppermost secondary and posterior temporals are very large, second in size only to the preorbital. If the superior postocular is considered to be a true temporal, the temporal pattern would then be termed 2 + 2 + 3, with the upper primary temporal entering the orbit, and only a single (inferior) postocular being present. It is possible that the true postoculars have been lost and replaced by two additional temporals, in which case the temporal pattern would be 1 + 2 + 2 + 3. No indication of keels are visible on the two rows of post-temporal scales; they appear smooth and shiny like the temporals and supralabials.

The shields on the dorsum of the head are difficult to interpret in lateral view (Fig. 2). The rostral is clearly visible from above. The lateral aspects of two shields are visible on the dorsum of the snout between the rostral and preorbital, the suture between them intersecting the nostril at its anterior border. Based upon position, they would be called a cranial internasal and a caudal prefrontal, the latter more than twice the length of the former. Since the dorsal midline is not visible, it can only be speculated whether one or both of them are fused into a single transverse shield, a common occurrence in many burrowing snakes. The prefrontals may be fused into a single transverse shield as in *Trachischium* or *Opisthotropis,* the internasals may be fused together as in *Atretium* or *Limnophis,* or both the prefrontals and internasals may be fused into single longitudinal shields as in *Prosymna* or *Rhabdops.* A peculiarity of the prefrontal is that its posterior edge appears to be raised up from the surface of the head, perhaps an artifact of collecting or the result of previous damage. The frontal shield is just barely visible medial to the supraocular but neither its size nor shape can be determined. The lateral apex of what should be a large parietal shield is visible dorsal and medial to the upper postocular and the temporals.

In ventral view, the head is barely distinct from the neck, exhibiting a slight taper to a bluntly rounded snout, and the lower jaw is countersunk (Fig. 3). There appear to be eight infralabials; the first to sixth are visible in ventral view while the seventh and eight are discernible in lateral view. The first pair of infralabials is in contact on the midline, separating the triangular mental shield from the genials. The first four infralabials increase in size and length posteriorly, the fourth being the largest, the fifth slightly smaller than the fourth and second in size, the last three smallest in size and elongate in shape. The anterior genials are broad, wider than all of the infralabials,

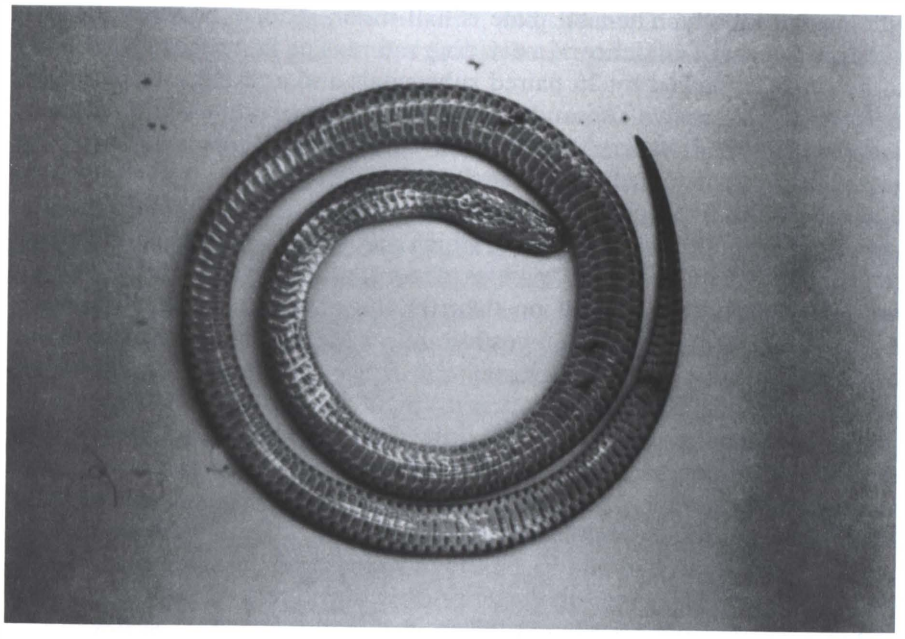

FIG. 3.—Ventral view of *Cryptophidion:* slide MCZ-K950.

and about 1.5 times as long as wide. On the ventral midline between the pregenials and the first preventral are two pairs of small scales (technically postgenials, but only 1/6 the size of the pregenials and 1/3 the size of the costal scales in row I), three times as long as broad with diverging posterior tips. An expandable mental groove appears to be lacking between the genials. A suture separating the pregenials is visible, but it does not extend caudally; the bases of the two oblique postgenials on the left cover the respective bases of the pair on the right and cross the midline. On each side of the midline between the genials, infralabials, and preventrals are three oblique rows of small elongated gulars. Each row consists of two to three scales only slightly larger than the four postgenials. Along the midline between the postgenials and the first ventral are five diamond-shaped preventrals, each of which is barely broader than long and slightly larger than the one preceding it.

There are 172 ventrals, an undivided anal plate, and 27 subcaudal on the ventral surface of *Cryptophidion* (Fig. 3). The ventrals are transverse with slightly convex posterior margins, distinctly narrower than the body diameter, and occupying about 2/3 of the venter width. Anteriorly, the ventral width/body diameter ratio is 0.67, at midbody it is 0.60, and posteriorly it is 0.70. Scales of row I are visible on either side of the ventrals for the entire length of the body, while scales of row II are barely visible along the right

side near midbody. The anal plate is half-moon shaped, nearly as deep as wide, and without evidence of a dividing suture. The first subcaudal appears to be single, followed by 26 paired subcaudals and a terminal spine nearly as long as the last two subcaudals. The tail is approximately 11 percent of the total length. It tapers sharply from the vent to the tip, suggesting the gender of the type to be female. The length of the specimen is unknown, but based upon body proportions it appears to be a small snake less than 300 mm long. Only the scales of row I, which are often smooth even in keeled-scaled snakes, and the midbody scales of row II are visible in Fig. 3. However, no trace of keels are present on them or the post-temporals of the head. Additionally, the ventrolateral costals appear smooth, glossy and probably irridescent, characteristics universally present in burrowing snakes, so it is assumed that the dorsal scutellation is smooth.

The head appears to be dark plumbeus or black in color, most of the shields exhibiting narrow, silver posterior margins. The venter appears immaculate bluish-gray. The anterior base of each of the subcaudals has a black border whose proportional size increases towards the tail tip such that the last few subcaudals are almost entirely black. Scales in row I also possess similar black bases, covering the anterior ⅓ of the scale near the neck, and about ⅔ of the scale near the tail. The visible portion of the scales in row II indicates that they are uniformly dark, suggesting a uniformly dark plumbeus or black dorsum, like the head.

Discussion

The following characteristics are positively correlated with a burrowing habitat in snakes: narrow head, depressed snout, pointed rostral, countersunk lower jaw, reduced nasals, nasal separated from rostral, reduced eyes, fusion or loss of lateral and dorsal head shields, reduction in number of labials, reduction in number of longitudinal scale rows, absence of scale row reduction, short tail with reduced number of subcaudals, narrow ventrals, absence of keels on dorsal scales, and reduction in overall size. Since *Cryptophidion* possesses most of these characters, there is little doubt that it is a specialized fossorial snake.

Among the colubroids of the world, *Cryptophidion* is unique in possession of the enormous preorbital shield. Several genera (*Dendrolycus, Cryptolycus* and *Lycophidion* of Africa and *Lycodon* of Asia) exhibit a dorsoventrally enlarged preocular that extends onto the dorsum of the head and may contact the frontal, but in no case is the shield enlarged anteriorly to cover half the snout as in *Cryptophidion.* The homology of this shield is uncertain, although it is remarkably similar to the prefrontal of *Cylindrophis* and the Uropeltidae, and to the shield termed the preocular in *Xenopeltis.* It occupies the position of the prefrontal in *Xenocalamus.* The nasals of *Cryptophidion* are also peculiar. Most snakes, whether fossorial or not, exhibit nasal shields that

are considerably larger than the nostrils, and concave nasals are commonly found only in arboreal snakes, the sole secretive exception being *Achalinus* from eastern Asia.

Cryptophidion is a perplexing snake as it combines several generalized characters in conjunction with the specialized features mentioned above. Neither the large temporal shields nor the high number of supralabials are characteristic of a fossorial snake. Underwood and Kochva (1993) pointed out that the primitive supralabial pattern for pythonids, *Xenopeltis, Loxocemus,* and atractaspids is 3 : 2 : 3, exactly as found in *Cryptophidion.* Typically in burrowers, the supralabials are reduced in number to 4–6 by fusion with their neighbors. Also, the temporals are usually fused into a single elongate shield or they are lost, resulting in contact of one or more supralabials with the parietal. Neither of these trends is apparent in *Cryptophidion*; the posterior head scutellation remains generalized as in a terrestrial form.

Rabb and Marx (1973) analyzed the ecology and geography of more than 500 species of colubroid snakes, and showed that fossorial snakes form the greatest percentage of snakes in any region of the world; 33 percent of the total ophiofauna consists of burrowers in Africa, while 28 percent are fossorial in the Orient. They also determined that terrestrial snakes are the most primitive, with aquatic, arboreal and subterrestrial snakes being intermediate, and fossorial snakes the most derived.

Inger and Marx (1965) hypothesized three radiations that occurred among tropical Old World colubroids, one in India and Southeast Asia, one in Malaysia and Indonesia, and one in Africa. The natricine tribe Aspidurini of India, Southeast Asia, and the Philippines probably resulted from one radiation and includes *Aspidura, Blythia, Haplocercus, Myersophis, Oxyrhabdium, Rhabdops, Tetralepis, Trachischium,* and *Xylophis* (Inger and Marx 1965, Wallach 1988). A second burrowing radiation probably resulted in the colubrine subfamily Calamariinae of Malaysia and Indonesia and includes *Brachyorrhos, Calamaria, Calamorhabdium, Collorhabdium, Elapoidis, Etheridgeum, Macrocalamus, Oreocalamus,* and *Pseudorabdion.*

The Atractaspididae, a recently recognized family containing the aparallactines plus *Atractaspis,* probably originated from a third radiation of burrowers in Africa. It includes *Amblyodipsas, Aparallactus, Atractaspis, Brachyophis, Chilorhinophis, Elapotinus, Hypoptophis, Macrelaps, Micrelaps, Poecilopholis, Polemon,* and *Xenocalamus* of Africa plus *Pararhadinaea* of Madagascar (Witte and Laurent 1947, Laurent 1950, Wallach 1991, Underwood and Kochva 1993). Although Inger and Marx (1965) included *Prosymna* (as *Stenorhabdium*) in the aparallactine radiation of Africa, it is not related to the atractaspids and represents an independent fossorial line. Another radiation of burrowers in Africa occurred among the Elapidae, members of which include *Elapsoidea, Homoroselaps, Paranaja,* and *Walterinnesia.*

At least two fossorial radiations have occurred among the terrestrial proteroglyphs or oxyuranids of Australia. One radiation consists of snakes possessing single anal plates and subcaudals, and it is here named the tribe Rhinoplocephalini (Division B, section III, clade 8 of Wallach 1985). It includes *Elapognathus, Rhinoplocephalus* and *Suta* as defined by Hutchison (1990). The other radiation, the tribe Vermicellini (Division C, clades 10–11 of Wallach 1985), exhibits divided anal shields and paired subcaudals, and includes *Cacophis, Furina, Simoselaps* and *Vermicella* (*sensu* Hutchison 1990). A third radiation took place in the southwestern Pacific region. The Parapistocalamini includes *Aspidomorphus, Loveridgelaops, Micropechis, Ogmodon, Parapistocalamus, Salomonelaps,* and *Toxicocalamus.*

In the New World, a number of sharp-nosed burrowing radiations took place. One is exemplified by the xenodontine *Enulius,* whose precise relationships are unknown. Another radiation resulted in the xenodontine tribe Elapomorphini and includes two genera, *Elapomorphus* and *Apostolepis,* the latter containing some sharp-nosed species similar to *Cryptophidion.* A third and very successful radiation among the colubrine tribe Sonorini has produced the sharp-nosed genera *Chilomeniscus, Conopsis, Ficimia, Geagras, Gyalopion, Pseudoficimia,* and *Toluca.*

Family allocation. Determining the family to which *Cryptophidion* belongs represents, at this time, an insurmountable challenge. A dorsal view of the head and body might have provided the necessary evidence to determine the correct family. With the present evidence, we must examine a number of different higher and lower families. We recognize 19 families in the Serpentes (Table 1), divided into the Scolecophidia and Alethinophidia (Underwood 1967, 1979, McDowell 1987, Smith et al. 1977, Dowling and Duellman 1978, Kluge 1991, 1993, Zug 1993). Clearly, the new taxon in no way resembles the scolecophidians, so the Anomalepididae, Typhlopidae, and Leptotyphlopidae are eliminated as possibilities.

The Alethinophidia is composed of the Henophidia, with four superfamilies (Anilioidea, Booidea, Tropidophioidea and Bolyerioidea), and the Caenophidia with two (Acrochordoidea and Colubroidea) (McDowell 1975). Only the Anilioidea and Booidea have representatives that share even a remote resemblance to the new taxon, so the Tropidophiidae and Bolyeriidae are excluded from consideration. The anilioids now are represented by four families (Anomochilidae, Aniliidae, Cylindrophiidae and Uropeltidae) (Cundall, Wallach, and Rossman, in press); neither the Anomochilidae nor Aniliidae share any similarity to the new taxon, and are thus ruled out. Two genera of anilioids, *Cylindrophis* (Cylindophiidae) and *Platyplectrurus* (Uropeltidae), exhibit certain features in common with *Cryptophidion.* Of the four families in the Booidea (Xenopeltidae, Loxocemidae, Pythonidae and Boidae), the latter three can be excluded from consideration; only *Xenopeltis* displays a superficial resemblance to the new genus. All three henophidian genera can be eliminated on the basis of their barely differentiated ventrals,

TABLE 1.—Classification of the Serpentes (with number of genera, species in each family).

Infraorder Scolecophidia—Blind and worm snakes
- Superfamily Typhlopoidea—Blind snakes
  - Family Anomalepididae—Primitive blind snakes (4, 15)
  - Family Typhlopidae—Derived blind snakes (3, 215)
- Superfamily Leptotyphlopoidea—Worm snakes
  - Family Leptotyphlopidae—Worm snakes (2, 80)

Infraorder Alethinophidia—Typical snakes
- Parvorder Henophidia—Primitive snakes
  - Superfamily Anilioidea—Protoboids
    - Family Anomochilidae—Asian false blind snakes (1, 2)
    - Family Aniliidae—South American false coral snakes (1, 1)
    - Family Cylindropiidae—Asian pipe snakes (1, 8)
    - Family Uropeltidae—Indian and Sri Lankan shieldtails (9, 46)
  - Superfamily Booidea—Pythonies and boids
    - Family Xenopeltidae—Asian sunbeam snake (1, 2)
    - Family Loxocemidae—Mexican python (1, 1)
    - Family Pythonidae—Old World pythons (8, 24)
    - Family Boidae—Neotropical and Malagasy boas (9, 42)
  - Superfamily Tropidophioidea—Procolubroid boas
    - Family Tropidophiidae—Neotropical dwarf boas (4, 21)
  - Superfamily Bolyerioidea—Splitjawed boas
    - Family Bolyeriidae—Round Island boas (2, 2)
- Parvorder Caenophidia—Spectacled snakes
  - Superfamily Acrochordoidea—Wartsnakes and filesnakes
    - Family Acrochordidae—Asian wartsnakes and filesnakes (1, 3)
  - Superfamily Colubroidea—Advanced snakes
    - Family Viperidae—Cosmopolitan Vipers (32, 230)
    - Family Atractaspididae—African side-stabbing snakes (14, 66)
    - Family Elapidae—Afroasian and American palatine erectors (19, 121)
    - Family Hydrophiidae—Australasian palatine draggers (44, 206)
    - Family Colubridae—Cosmopolitan colubrids (287, 1676)

which are about twice the width of scales in row I in *Cylindrophis* and *Platyplectrurus,* three times the costal width in *Xenopeltis.* Also, the tails of *Cylindrophis* and *Platyplectrurus* are very short, have few subcaudals, and lack a sharp terminus, while *Xenopeltis* possesses a divided anal plate. Therefore, all henophidian families are excluded from consideration.

Among the Caenophidia, the Acrochordidae exhibits no similarity to the new taxon, nor to any other living snake, so it is eliminated from further consideration. The colubroids consist of five families (Viperidae, Atractaspididae, Elapidae, Hydrophiidae and Colubridae) with the Colubridae containing more than 60 percent of all known snake species. The new taxon is obviously not related to either the Viperidae or the marine Hydrophiidae (Hydrophiinae), so they are excluded. Therefore, all snakes are eliminated from consideration except secretive or fossorial members of the following four colubroid families: the Atractaspididae (solenoglyphous Atractaspidi-

nae and opisthoglyphous Aparallactinae) of Africa and extreme southwestern Asia, the proteroglyphous Elapidae of Asia, Africa and America, the terrestrial proteroglyphous Hydrophiidae (Oxyuraninae) of Australia and the South Pacific, and the cosmopolitan aglyphous and opisthoglyphous Colubridae.

Unfortunately, there is no external character that allows discrimination between the Atractaspididae, Elapidae, Oxyuraninae, and Colubridae. While the majority of Colubridae possess a loreal shield and its absence characterizes the Atractaspididae, Elapidae and Hydrophiidae, it is with the minority of colubrid taxa that have lost the loreal (due to burrowing habits) that the new taxon probably has its affinity. The only recognizable "external" feature that can separate these families is the dentition type, examination of which requires opening of the mouth, an impossibility in this case since the type specimen is missing. Thus, even though the new species has the gestalt of a colubrid, the possibility exists that it could be an atractaspid, elapid, or oxyuranid if its dentition is opisthoglyphous or proteroglyphous.

The presence of a temporolabial shield allies *Cryptophidion* with the Oxyuraninae. Of the 16 applicable characters of *Cryptophidion* analyzed by Marx and Rabb (1965), only five were considered derived for colubroids: nasal-rostral separation, nasal concavity, absence of loreal, small eye size, and reduced number of subcaudals. The latter three are present in all four families under consideration. Nasal-rostral separation is found only in the Atractaspididae (*Brachyophis, Hypoptophis, Polemon*) and *Colubridae* (*Ficimia, Stenorrhina*), while the concave nasal is present only in the Colubridae. These data suggest that *Cryptophidion* belongs in the Colubridae.

Generic relationships. In searching for the most closely related genus (or sister group) to *Cryptophidion,* the logical first comparison is with other sharp-nosed taxa. The following sharp-nosed genera are among those listed in Tables 2–5: one Indo-Malayan genus (*Calamorhabdium*), four African genera (*Amblyodipsas, Brachyophis, Hypoptophis* and *Xenocalamus*), one Australian genus (*Simoselaps*), one Fiji Island genus (*Ogmodon*), one South American genus (*Apostolepis*), one Central American genus (*Enulius*), and seven Mexican genera (*Chilomeniscus, Conopsis, Ficimia, Geagras, Gyalopion, Pseudoficimia* and *Toluca*). However, inspection of the tables reveals that they all differ from *Cryptophidion* in at least several characters, some of generic weight and others of specific importance. Also, the search need not be limited to sharp-nosed burrowers as some genera are polymorphic with respect to snout profile, so the nearest relative of *Cryptophidion* could lack a sharp rostrum. Among the genera listed in the tables, *Calliophis* and *Pseudorabdion* of Asia, *Amblyodipsas, Atractaspis, Elapsoidea* and *Micrelaps* of Africa, and *Apostolepis* of South America contain species with variable profiles.

Some of the Aspidurini of Asia possess depressed snouts, but none of them show the development of a sharp rostrum as in *Cryptophidion. Cryptophidion* exhibits similarities to *Myersophis* of the Philippines in its small size, lateral head shape with a depressed snout, divided nasal, postnasal smaller than nostril, two supralabials entering the orbit, reduced eye, similar eye-snout ratio, countersunk lower jaw, four narrow infralabials contacting anterior pair of broad genials, narrow ventrals, nearly identical ventral and subcaudal counts, single anal and paired subcaudals, short sharply-pointed tail, smooth and and glossy scales, and dark venter. It differs from *Myersophis* in its broader snout, greater number of supralabials and infralabials, separation of prenasal from rostral, absence of loreal, presence of enlarged preorbital, two large postoculars, single primary temporal with absence of parietal-labial contact, two secondary temporals, absence of temporolabial, mental separated from pregenials by first infralabials, and absence of light supralabial borders (Taylor 1963, Leviton 1983).

The geographically nearest sharp-nosed burrower, *Calamorhabdium* of the Calamariinae, differs from *Cryptophidion,* in absence of snout depression, ventral count, supralabials and infralabials, mental contacting pregenials, single nasal in contact with rostral, absence of preocular, single postocular, absence of temporals, and ventral coloration (Table 2). *Macrocalamus* of Malaysia resembles *Cryptophidion* in many respects but it differs in ventral count, infralabial number, enlarged postgenials, nasal shield, temporolabial shield, rostral shape, and ventral coloration.

Among the Atractaspididae (Table 3), only *Brachyophis, Hypoptophis, Xenocalamus,* and some species of *Amblyodipsas* exhibit the sharply-pointed snout as found in *Cryptophidion.* However, they differ from *Cryptophidion* in the following characters. *Amblyodipsas* and *Xenocalamus* have a divided anal, fewer supralabials and infralabials, nasal in contact with rostral, no preocular, and no anterior temporal, no temporolabial, and a light venter. *Brachyophis* has fewer ventrals and subcaudals, fewer supralabials, enlarged postgenials, entire nasal, absence of temporals and temporolabial, smaller eye and greater eye-snout ratio. *Hypoptophis* has fewer ventrals, greater number of single subcaudals, fewer supralabials, enlarged postgenials, and no temporolabial. Among the Elapidae, *Walterinnesia* most closely resembles *Cryptophidion,* but differs in snout profile, number of ventrals and subcaudals, nasal in contact with rostral, nostril larger than nasal, number of supralabials, absence of temporolabial, enlarged postgenials, divided anal, and light venter.

Cryptophidion closely resembles the African *Lycophidion* of the Colubridae. Both genera share a head barely distinct from the neck, similar cephalic profile with depressed snout and pointed rostrum in lateral view and tapered head with a blunt snout in ventral view, eight supralabials with fourth and fifth entering orbit, divided nasal, single preocular (preorbital) extending

TABLE 2.—Comparison of *Cryptophidion* with Asian genera of Cylindrophiidae, Uropeltidae, Xenopeltidae, Elapidae and Colubridae.[1,2]

Genus	TA	V	VP	A	SC	CT	TP	SL	SLO	IL	IP
Cryptophidion	?C	172	1	1	27	2	0.11	8	4+5	8	4
Achalinus	CXX	132–191	2	1	39–98	1	0.09–0.32	6–7	4+5/5+6	5–7	3
Aspidura	CNA	101–159	1	1	11–39	3	0.06–0.18	5–6	3/4	6–8	4–5
Blythia	CNA	127–155	?	2	18–32	2	0.11–0.13	5–6	3+4	6	4
Brachyorrhos	CC	146–182	2	3	20–46	3	0.11–0.13	6–7	3/4/3+4	7	4
Calamaria	CC	119–304	2	1	6–44	2	0.03–0.15	4–6	2+3/3+4	4–6	2–3
Calamorhabdium	CC	125–140	1	1	10–31	2	0.05–0.11	5	3+4	6	3
Calliophis	EEC	174–320	1	2	15–44	3	0.04–0.18	6–7	3+4	6–8	3–5
Collorhabdium	CC	144–165	?	1	22–32	2	0.10–0.15	5	3+4	5	3–4
Cylindrophis	Cy	176–254	0	3	4–10	3	0.02–0.04	6	3+4	5–8	3
Elapoidis	CC	146–163	?	1	70–91	2	0.25–0.26	6	3+4	7	3–4
Etheridgeum	CNA	114	1	2	15+	2	?	7	3+4	8	3
Haplocercus	CNA	174–217	3	1	37–56	1	0.14–0.16	6–7	4	7	4
Lycodon	CCLy	128–256	3	3	34–208	3	0.15–0.33	7–10	3–5/4+5/4–6	8–11	3–5
Macrocalamus	CC	109–147	?	1	17–32	2	0.10–0.11	7–8	4+5	6–7	4
Maticora	EEM	197–306	1	1	15–52	2	0.06–0.12	6	3+4	5–7	3–4
Myersophis	CC	175–179	1	1	28–29	2	0.09–0.10	6	3+4	7	4
Oreocalamus	CC	125–132	2	1	20–32	2	0.10–0.14	7–8	3+4/4+5	7	4
Oxyrhabdium	CC	154–191	2	1	33–70	2	0.15–0.30	6–9	4+5/5+6	6–7	4–5
Plagiopholis	CNP	107–142	3	1	16–31	3	0.11–0.13	5–6	3/3+4	6	3
Platyplectrurus	U	158–175	0	2	8–16	2	0.03–0.07	4	3	5	0
Pseudorabdion	CC	113–166	2	1	11–60	2	0.05–0.24	5–6	3+4	6–7	3–5
Rabdion	CC	137–160	2	1	21–34	2	0.11–0.17	5–6	3+4	6	3
Rhabdops	CNA	186–217	3	2	56–77	2	0.15–0.22	5–6	0/3	6–8	4
Tetralepis	CC	187–201	?	2	43–56	2	0.14	4	3	5	4
Trachischium	CNA	113–165	2	3	26–44	2	0.11–0.16	6	3+4	5–6	4
Xylophis	CNA	108–147	2	1	14–38	2	0.06–0.14	4–5	2+3/3+4	6–7	4
Xenopeltis	X	152–196	0	2	16–32	2	0.07–0.14	7–8	4/4+5	6–9	3

Footnotes follow Table 5.

TABLE 2.—Continued.

Genus	M	G	N	L	PR	PO	PT	ST	TT	TS	NN	RS	LS	EP	SE	VC
Cryptophidion	1	1	2	0	1	2	1	2	3	1	2	3	1	0.4	2.5	1
Achalinus	1	5	7	1	0	0	1–2	2	2–4	0	3	1	1	0.32–0.40	1.9–3.1	8
Aspidura	1	4	5	0	0–1	2	1	1–2	0–1	0	2	2	1	0.27–0.46	2.3–3.3	2
Blythia	?	1	2	0	0	1	1	2	0	0	2	1	2	0.45	2.2	1
Brachyorrhos	1	1	7	0	0–1	2	1–2	2–3	0	0	2	2	1	0.35	2.8	2
Calamaria	3	2	1	0	1	1	0	0	1	0	2	2	2	0.23–0.50	1.7–4.0	2
Calamorhabdium	2	2	1	0	0	1	0	0	0	0	2	3	2	0.35	3.0	12
Calliophis	3	2	2	0	1	2	1–2	1–2	1–2	0	1	4	2	0.18–0.54	1.7–4.6	13
Collorhabdium	1	1	1	0	1	1	0	1	0	0	2	2	1	0.32–0.55	2.5–2.7	2
Cylindrophis	1	1	1	0	0	1	1	2	3	0	1	2	2	0.10–0.35	2.2–5.5	7
Elapoidis	?	2	2	1	0	1	0–1	2	2–3	0	1	2	2	0.28	3.6	2
Etheridgeum	1	2	2	0	1	2	0	1	0	0	1	2	2	0.36	1.8	2
Haplocercus	1	1	2	0	1	2	1	2	0	0	1	1	2	0.42–0.44	2.6–3.0	2
Lycodon	1	2	7	1–2	0–1	2–3	1–3	2–3	2–4	0	1	2	1	0.45–0.62	1.7–2.9	2
Macrocalamus	1	2	1	0–1	1	1	1	2	0	0	1	2	1	0.44–0.55	2.1–2.9	14
Maticora	1	2	1	0	1	2	1	2	0	0	1	1	2	0.25–0.40	2.3–3.5	4
Myersophis	2	1	2	1	0	1	0	1	3	0	2	2	1	0.35	3.1	1
Oreocalamus	?	2	1	1	1	1–2	1	2	0	0	?	2	1	0.51	2.0	2
Oxyrhabdium	1	1	2	1	0	1–2	1–2	2	3	0	2	2	1	0.40–0.53	2.2–3.3	2
Plagiopholis	1	2	6	0–1	1	2	1	1–2	0	0	1	1	2	0.43–0.52	1.8–2.2	2
Platyplectrurus	1	0	1	0	0	1	1	1	0	0	1	2	1	0.33	2.7	2
Pseudorabdion	2	2	4	0–1	0–1	0–1	0	1	0	0	1	4	1	0.33–0.50	2.0–5.6	2
Rabdion	1	2	1	1	0	1	0	1	0	0	2	2	2	0.35	2.8	2
Rhabdops	2	2	4	1	1–2	2–3	1	1	0	0	1	2	2	0.35–0.38	2.3–3.7	2
Tetralepis	?	2	1	1	1	2	1	1–2	2	0	1	2	2	0.30–0.40	2.0	5
Trachischium	1	2	6	1	1	1–2	1	1–2	0	0	1	1	2	0.28–0.38	2.2–2.6	2
Xylophis	2	1	5	1	0	1–2	1	2	0	0	2	2	1	0.23–0.35	2.4–3.3	1
Xenopeltis	1	1	5	0	1	2	1	1–2	3	0	3	2	1	0.18–0.33	3.3–6.4	2

TABLE 3.—Comparison of *Cryptophidion* with African and Malagasy genera of Atractaspididae, Elapidae and Colubridae.[1,2]

Genus	TA	V	VP	A	SC	CT	TP	SL	SLO	IL	IP
Cryptophidion	? C	172	1	1	27	2	0.11	8	4+5	8	4
Amblyodipsas	AAp	127–219	1	2	15–41	2	0.06–0.15	4–7	2+3/3+4	5–7	3–4
Aparallactus	AAp	108–191	2	1	20–65	3	0.12–0.23	6–7	2+3/3+4	6–7	3–4
Atractaspis	AAt	178–370	2	3	18–37	3	0.04–0.09	5–7	3+4/4	5–10	3–4
Brachyophis	AAp	103–123	1	3	8–14	3	0.03–0.08	7	4/4+5	8–9	3–4
Chamaelycus	CLL	176–193	2	1	38–43	2	0.11–0.13	6–7	3+4/3–5	7–8	4–5
Chilorhinophis	AAp	216–375	1	2	18–31	2	0.04–0.11	4–5	3	5–6	3–4
Cryptolycus	CLL	151–193	2	1	20–56	2	0.08–0.13	6–8	3+4/3–5	5–7	4–5
Elapotinus	AAp	163–175	2	2	35–36	2	0.13–0.14	7	3+4	8	4
Elapsoidea	EBB	131–181	2	1	13–33	2	0.07–0.11	7	3+4	6–7	3–4
Homoroselaps	EEB	160–240	1	2	22–43	2	0.08–0.15	6–7	3+4/4+5	6–7	3–4
Hypoptophis	AAp	101–118	2	1	31–45	1	0.15–0.23	7	3+4	7–8	4
Lycophidion	CLL	132–221	3	1	22–58	2	0.08–0.17	8	3+4/3–5/4+5	7–8	3–5
Macrelaps	AAp	158–172	2	1	35–52	1	0.12–0.18	7	3+4	7–9	3–4
Micrelaps	AAp	171–275	1	2	16–33	2	0.05–0.11	7–8	3+4	6–7	3–4
Paranaja	EBB	150–175	2	1	30–38	2	0.12–0.15	6–8	3+4	8	4
Pararhadinaea	AAp	147–187	1	2	32–41	2	0.11–0.18	7	3+4	8–9	3–4
Poecilopholis	AAp	166–178	?	2	23–31	2	0.11	4–5	3	5	3
Polemon	AAp	163–297	2	3	11–29	3	0.03–0.10	6–7	3/3+4	6–7	3–4
Prosymna	CC	107–208	2	1	15–57	2	0.07–0.18	5–6	3+4	7–9	3
Walterinnesia	EBB	180–200	3	2	40–53	3	0.11–0.15	7	3+4	8	4
Xenocalamus	AAp	183–296	1	2	20–37	2	0.04–0.11	5–6	2+3/3+4	5–7	3–4

Footnotes follow Table 5.

TABLE 3.—Continued.

Genus	M	G	N	L	PR	PO	PT	ST	TT	TS	NN	RS	LS	EP	SE	VC
Cryptophidion	1	1	2	0	1	2	1	2	3	1	2	3	1	0.4	2.5	1
Amblyodipsas	1	1	7	0	0	0–1	0	1	0	0	1	5	3	0.14–0.25	3.8–6.0	2
Aparallactus	1	3	7	0	1	1–2	0–1	1–2	0	0	1	1	2	0.30–0.48	1.9–4.0	2
Atractaspis	3	1	2	0	1	1–2	1–4	1–4	0–4	1	1	5	3	0.18–0.35	2.3-4.8	1
Brachyophis	1	2	1	0	1–2	1–2	0	0	0	0	2	3	1	0.20–0.27	4.0–5.0	9
Chamaelycus	1	5	2	1	0–1	1–2	1	2	3	0	1	2	2	0.5	2.3–2.4	4
Chilorhinophis	1	1	1	0	0–1	1	0	1	0	0	1	1	2	0.29–0.41	2.6–3.1	2
Cryptolycus	1	2	1	1	1	2	1	2	3	0	1	2	1	0.44	2.8	1
Elapotinus	1	2	4	0	1	1	1	2	0	0	1	1	2	0.23	4.0	2
Elapsoidea	1	2	2	0	1	2	1	2	0	0	1	5	2	0.40–0.46	1.7–2.6	2
Homoroselaps	1	2	1	0	1	1	0–1	1–2	2	0	1	1	2	0.32	2.4	2
Hypoptophis	1	2	3	0	1	2	1	1	0	0	1	3	1	0.27–0.35	3.0–4.0	1
Lycophidion	1	2	7	1	1	1–2	1	1–2	3	0	3	3	1	0.40–0.60	2.0–2.9	1
Macrelaps	1	1	6	0	0	1	0–1	1–2	2–3	0	1	2	3	0.18–0.20	3.8–4.5	1
Micrelaps	1	2	4	0	0	1	0–1	1–2	2–3	0	1	4	3	0.22–0.32	2.8–3.6	2
Paranaja	1	2	2	0	1	2–3	1–2	1–3	0	0	1	2	2	0.5	1.6	2
Pararhadinaea	1	2	5	0	1	1–2	1	2	3	0	1	1	2	0.30–0.50	1.9–2.3	1
Poecilopholis	1	2	1	0	1	2	1	1	0	0	1	1	?	?	?	4
Polemon	1	3	7	0	1	1–2	0–1	1	0–1	0	1	1	2	0.21–0.33	2.3–3.8	2
Prosymna	1	3	3	1	1–2	1–3	1–2	2	3	0	1	3	1	0.43–0.53	2.0–3.0	2
Walterinnesia	1	2	2	0	1–2	2	2–3	3	0	0	1	2	2	0.33	3.3	2
Xenocalamus	1	1	2	0	0	0–2	0	1	0	0	1	3	1	0.11–0.27	4.0–7.6	2

TABLE 4.—Comparison of *Cryptophidion* with Australian and South Pacific genera of Hydrophiidae (Oxyuraninae).[1,2]

Genus	TA	V	VP	A	SC	CT	TP	SL	SLO	IL	IP	M
Cryptophidion	?C	172	1	1	27	2	0.11	8	4+5	8	4	1
Aspidomorphus	HOP	138–185	3	2	19–41	2	0.10–0.14	6	3+4	7	3–4	1
Cacophis	HOV	140–200	3	2	25–52	2	0.10–0.15	6	3+4	6–7	4	1
Elapognathus	HOR	116–130	3	1	50–70	1	0.21–0.36	6	3+4	6	3–4	1
Furina	HOV	160–240	3	2	30–70	2	0.13–0.27	6–7	3+4	6–7	3–4	1
Loveridgelaps	HOP	193–222	3	1	25–38	3	0.09–0.10	7	3+4	7	4	1
Micropechis	HOP	178–223	3	2	37–55	2	0.12–0.14	6	3+4	7	3–4	1
Ogmodon	HOP	134–152	3	2	27–38	2	0.12–0.14	5–6	2–4/3+4	5–7	3	1
Parapistocalamus	HOP	159–169	3	3	31–35	2	0.11	6	3+4	6–7	3	3
Rhinoplocephalus	HOR	138–210	3	1	20–79	1	0.12–0.27	6–7	3+4	6–7	3–4	1
Salomonelaps	HOP	158–179	3	2	40–56	3	0.15–0.16	7	3+4	7	4	1
Simoselaps	HOV	104–235	3	2	14–40	2	0.06–0.15	5–6	3+4	6–7	3	1
Suta	HOR	125–213	3	1	18–42	1	0.09–0.19	6	3+4	6–7	3–4	1
Toxicocalamus	HOP	171–330	3	3	16–59	3	0.04–0.16	4–6	2+3/3+4	6	3–4	1
Vermicella	HOV	180–320	3	2	12–30	2	0.04–0.07	5–6	3/3+4	6–7	3	1

Footnotes follow Table 5.

TABLE 4.—Continued.

Genus	G	N	L	PR	PO	PT	ST	TT	TS	NN	RS	LS	EP	SE	VC
Cryptophidion	1	2	0	1	2	1	2	3	1	2	3	1	0.4	2.5	1
Aspidomorphus	2	2	0	1	2	2	2	3	1	1	2	2	0.46–0.60	1.6–2.4	2
Cacophis	2	7	0	1	2	1	1–2	0	1	1	2	2	0.33–0.45	2.2–2.8	1
Elapognathus	2	1	0	1	2	2	2	3	1	1	2	2	0.51–0.70	1.4	9
Furina	2	7	0	1	2	2–3	2–3	0–3	1	1	2	1	0.32–0.52	1.9–3.6	2
Loveridgelaps	2	5	0	1	1–2	1	2	0	1	1	2	2	0.43	2.2	4
Micropechis	2	2	0	1	2	2	2	0	1	1	2	2	0.42	2.2	2
Ogmodon	2	2	0	0–1	1	0	1	2	0	1	2	3	0.40	2.5–2.6	2
Parapistocalamus	2	7	0	0–1	1	1	1–2	0	0	1	2	2	0.25–0.39	2.4–3.8	2
Rhinoplocephalus	2	1	0	1	1–3	1–2	1–2	2–3	1	1	2	2	0.33–0.60	2.0–2.8	2
Salomonelaps	2	2	0	1	2	1	2	0	1	1	2	2	0.37–0.48	1.8–2.7	2
Simoselaps	2	4	0	1	1–2	0–1	1–3	0–2	1	1	3	1	0.18–0.47	1.9–6.0	2
Suta	2	1	0	1	1–2	1–2	1–3	2–3	1	1	2	2	0.35–0.55	1.4–2.5	2
Toxicocalamus	2	5	0	0–1	0–2	0–1	1–2	0	0	1	1	2	0.41–0.50	2.6–4.0	2
Vermicella	2	1	0	0–1	2	1	1	2	0	1	2	2	0.25–0.33	3.0–5.2	4

TABLE 5.—Comparison of *Cryptophidion* with American genera of Elapidae and Colubridae.[1,2]

Genus	TA	V	VP	A	SC	CT	TP	SL	SLO	IL	IP
Cryptophidion	? C	172	1	1	27	2	0.11	8	4+5	8	4
Adelphicos	CXG	113–148	1	2	19–51	2	0.09–0.22	6–8	3+4	6–7	4–5
Apostolepis	CXA	226–265	2	2	24–45	2	0.06–0.15	6–7	2+3	7–8	4–5
Atractus	CXG	130–213	2	1	9–67	2	0.04–0.26	5–8	2+3/3+4/4+5	5–9	3–5
Carphophis	CXH	106–150	2	2	21–41	2	0.08–0.21	5	3+4	5–6	4
Chersodromus	CXN	122–138	3	1	36–42	2	0.17–0.23	6–7	3+4	7–8	4–5
Chilomensicus	CCS	103–132	3	2	22–33	2	0.09–0.14	7	3+4	7–9	3–5
Conopsis	CCS	118–145	3	2	22–41	2	0.14–0.20	5–7	2+3/3+4	5–8	4
Elapomorphus	CXA	128–266	2	2	20–47	2	0.06–0.17	6	2+3+4	6–8	3–5
Emmochliophis	CXN	136–140	?	1	91–97	2	0.35	8	4+5	8	4
Enulius	CX	129–216	3	2	82–121	2	0.33–0.39	5–8	2+3/3+4	6–8	3–4
Farancia	CXH	155–208	3	3	31–55	2	0.08–0.20	6–8	3+4	7–10	4–5
Ficimia	CCS	126–157	2	2	26–44	2	0.13–0.19	5–8	3+4	5–8	3
Geagras	CCS	113–124	3	2	25–33	2	0.11–0.13	5	3	6	4
Geophis	CXG	115–185	2	1	19–66	2	0.07–0.22	4–7	3/3+4	5–8	3–4
Gyalopion	CCS	116–140	2	3	20–37	2	0.10–0.18	6–7	3+4	6–9	3–4
Leptomicrurus	EEM	212–379	2	2	12–30	2	0.04–0.08	6–7	2+3/3+4	6–7	3–4
Micruroides	EEM	205–245	3	2	19–31	2	0.06–0.08	7	3+4	6–7	3
Micrurus	EEM	156–329	3	2	15–62	2	0.07–0.16	7	3+4	6–7	4
Ninia	CXN	123–164	3	1	34–106	2	0.15–0.33	5–7	3+4+5	5–7	4–5
Pseudoficimia	CCS	141–163	3	2	34–52	2	0.14–0.20	7	3+4	7	3–4
Stenorrhina	CXS	136–182	3	2	31–48	2	0.12–0.19	7–9	3+4	7–8	3
Stilosoma	CCLa	223–277	2	1	33–48	2	0.07–0.14	6	3+4	5–8	3–4
Tantilla	CCS	103–197	1	2	21–92	2	0.16–0.36	5–8	3+4	5–8	3–5
Tantillita	CCS	103–125	2	2	28–56	2	0.17–0.30	6–7	3+4	6	4
Toluca	CCS	111–141	2	2	23–45	2	0.14–0.20	7	3+4	6–7	3–4
Virginia	CNT	109–139	3	2	25–50	2	0.12–0.24	5–6	3+4	5–7	4

Footnotes immediately follow this table.

TABLE 5.—Continued.

Genus	M	G	N	L	PR	PO	PT	ST	TT	TS	NN	RS	LS	EP	SE	VC
Cryptophidion	1	1	2	0	1	2	1	2	3	1	2	3	1	0.4	2.5	1
Adelphicos	1	1	2	1	0–1	2	1	1	1–3	0	1	2	2	0.27	2.7	2
Apostolepis	1	2	1	0–1	0	2	0	0–1	0–1	1	1	5	2	0.29–0.37	2.8–4.4	2
Atractus	1	1	2	0–1	0–1	1–2	0–2	1–2	2–4	0	1	2	2	0.26–0.46	1.6–3.1	15
Carphophis	1	1	1	1	0	1	1	1–2	0	0	1	2	1	0.32–0.33	2.1–2.6	2
Chersodromus	2	1	6	1	0	1–2	0–1	1–2	3	0	1	1	2	0.33	4.0	10
Chilomensicus	1	1	6	0	1	1–2	1	1	0	0	1	3	1	0.30–0.50	3.0–4.0	2
Conopsis	1	1	1	0–1	1	2	1	1–2	2–3	0	1	3	1	0.29–0.50	2.1–2.7	2
Elapomorphus	1	2	1	0	1	1–2	0–1	1	2	0	1	2	2	0.28–0.40	2.8–4.0	10
Emmochliophis	1	2	2	0	1	1–2	1	2	3	0	2	2	1	0.27–0.36	3.2–4.2	2
Enulius	1	1	2	1	0	2	0–1	1–2	1–2	0	?	3	2	0.3–0.5	2.5–2.7	2
Farancia	1	3	1	1	0	2	1–2	2	0	0	1	1	2	0.39–0.43	1.8–2.2	11
Ficimia	1	1	6	0	1	1–2	1	2	0	0	1	3	1	0.32–0.40	2.5–4.0	2
Geagras	1	2	2	0	1	1	1	2	0	0	1	3	1	0.25–0.29	3.8–6.0	2
Geophis	1	1	2	1	0–1	0–2	0–1	1–2	2	0	1	2	2	0.20–0.47	2.1–5.4	2
Gyalopion	1	1	3	0–1	1	1–2	1	2	0	0	1	3	1	0.42–0.50	2.2–2.5	2
Leptomicrurus	2	2	6	0	1	2	0–1	1	2	0	1	2	2	0.18–0.28	3.3–4.8	4
Micruroides	1	1	5	0	1	1–2	1	2	3	0	1	1	2	0.25–0.31	2.0–3.5	4
Micrurus	1	2	2	0	1	2	0–1	1–2	2	0	1	2	2	0.25–0.27	2.6–3.8	4
Ninia	1	2	6	1	0	2	1	1–2	2	0	1	2	2	0.29–0.51	1.9–2.7	16
Pseudoficimia	1	3	3	0	1	2	1	2	3	0	1	3	1	0.40–0.43	2.0–2.9	2
Stenorrhina	1	1	7	0–1	1	2	1–2	1–3	3	0	1	2	2	0.32–0.50	2.0–2.7	2
Stilosoma	1	2	1	0	0–1	2	0	1	1–2	0	1	2	1	0.33–0.38	2.5–3.3	7
Tantilla	1	2	2	0	0–1	1–2	1	1–2	0	0	1	2	2	0.41–0.60	1.7–3.1	2
Tantillita	1	3	1	0	1	2	0–1	1	0	0	1	2	2	0.43–0.56	1.8–2.4	2
Toluca	1	1	1	0–1	1	2	1	1–3	3	0	1	3	1	0.38–0.50	1.7–2.6	2
Virginia	1	2	2	1	0	1–3	0–1	1–2	0	0	?	2	1	0.44–0.70	1.4–2.0	2

[1] Key to abbreviations in Tables 2–5: A = anal plate (1: entire, 2: divided, 3: variable), CT = subcaudal type (1: single, 2: paired, 3: variable), EP = eye proportion (vertical eye diameter/head depth), G = number of pairs of enlarged genials (1: 1, 2: 2, 3: 3, 4: 1–2, 5: 2–3), IL = number of infralabials, IP = number of infralabials contacting pregenials, L = loreal (0: absent, 1: present), LS = lateral snout profile (1: depressed, 2: not depressed, 3: variable), M = mental contacting pregenials (1: no, 2: yes, 3: variable), N = nasal (1: entire, 2: divided, 3: semidivided, 4: 1+½, 5: 1+2, 6: ½+2, 7: 1+½+2), NN = nasal larger than nostril (1: yes, 2: no, 3: variable), PO = number of postoculars, PR = number of preoculars, PT = number of primary (or anterior) temporals, RS = lateral rostral shape (1: rounded, 2: blunt, 3: pointed, 4: 1+2, 5: 2+3), SC = total subcaudals, SE = snout-eye proportion (snout length/horizontal eye diameter), SL = number of supralabials, SLO = supralabials entering orbit, ST = number of secondary (or posterior) temporals, TA = taxonomic allocation (AAp: Atractaspididae: Aparallactinae, AAt: Atractaspididae: Atractaspidinae, C: Colubridae, Cy: Cylindrophiidae, CC: Colubridae: Calamariinae, CCLa: Colubridae: Colubrinae: Lampropeltini, CCLy: Colubridae: Colubrinae: Lycodontini, CCS: Colubridae: Colubrinae: Sonorini, CLL: Colubridae: Lycophidini, CNA: Colubridae: Natricinae: Aspidurini, CNP: Colubridae: Natricinae: Pseudoxenodontini, CNT: Colubridae: Natricinae: Thamnophiini, CX: Colubridae: Xenodontinae, CXE: Colubridae: Elapomorphini, CXG: Colubridae: Xenodontinae: Geophiini, CXH: Colubridae: Xenodontinae: Heterodontini, CXN: Colubridae: Xenoderminae: Nothopsini, CXX: Colubridae: Xenoderminae: Xenodermini, EBB: Elapidae: Bungarinae: Bungarini, EEC: Elapidae: Elapinae: Calliophiini, EEM: Elapidae: Elapinae: Maticorini, HOP: Hydrophiidae: Oxyuraninae: Parapistocalamini, HOR: Hydrophiidae: Oxyuraninae: Rhinoplocephalini, HOV: Hydrophiidae: Oxyuraninae: Vermicellini, U: Uropeltidae, X: Xenopeltidae), TP = tail proportion (tail length/total length), TS = temporolabial shield (0: absent, 1: present), TT = number of tertiary temporals, V = total ventrals, VC = color of venter (1: light, 2: dark, 3: striped, 4: crossbarred or ringed, 5: spotted, 6: checkered, 7: blotched, 8: 1+2, 9: 1+4, 10: 1+5, 11: 4+5, 12: 4+6, 13: 5+7, 14: 1+3+6, 15: 1+4+5, 16: 4+5+7), VP = ventral proportion (ventral width/body width, 0: <0.5, 1: 0.5–1.0, 2: ≈1.0, 3: >1.0).

[2] Literature sources for Tables 2–5: *Achalinus* (Maki 1931, Bourret 1935, Pope 1935, Deuve 1970, Ota and Toyama 1989); *Adelphicos* (Smith 1942, Campbell and Ford 1982); *Amblyodipsas* (Witte and Laurent 1947, Broadley 1971b); *Aparallactus* (Loveridge 1944, Witte and Laurent 1947); *Apostolepis* (Strauch 1884, Lema 1978, 1993); *Aspidomorphus* (Brongersma 1934, McDowell 1967); *Aspidura* (Deraniyagala 1955, Smith 1943, Gans and Fetcho 1982); *Atractaspis* (Laurent 1945, 1950, Broadley 1991); *Atractus* (Savage 1960, Hoogmoed 1980, Dixon and Soini 1986); *Blythia* (Smith 1943); *Brachyophis* (Witte and Laurent 1947, Lanza 1966); *Brachyorrhos* (Rooij 1917); *Cacophis* (Hoser 1989, Cogger 1992); *Calamaria* (Inger and Marx 1965); *Calamorhabdium* (Rooij 1917, Ahl 1933); *Calliophis* (Maki 1931, Smith 1943, Leviton 1964); *Carphophis* (Clark 1970); *Chamaelycus* (Witte 1963); *Chersodromus* (Boulenger 1893, Taylor 1949); *Chilomeniscus* (Banta and Leviton 1963); *Chlorophis* (Witte and Laurent 1947, Loveridge 1958); *Collorhabdium* (Smedley 1932, Tweedie 1983); *Conopsis* (Taylor and Smith 1942b, Tanner 1961); *Cryptolycus* (Broadley 1968); *Cylindrophis* (Rooij 1917, Wall 1921, Mertens 1930, Mahendra 1936, Smith 1943, McDowell 1975); *Elapognathus* (Storr et al. 1986, Gow 1989, Cogger 1992); *Elapoidis* (Rooij 1917, Capocaccia 1976); *Elapomorphus* (Strauch 1884, Lema 1979, 1984); *Elapotinus* (Witte and Laurent 1947); *Elapsoidea* (Loveridge 1944, Broadley 1971a); *Emmochliophis* (Boulenger 1898, Fritts and Smith 1969, Hillis 1990); *Enulius* (Taylor 1951); *Etheridgeum* (Wallach 1988); *Farancia* (Mitchell 1982, Ernst and Barbour 1989); *Ficimia* (Smith and Taylor 1941, Hardy 1975b, 1990); *Furina* (Storr et al. 1986, Gow 1989, Hoser 1989, Cogger 1992); *Geagras* (Wilson and Meyer 1981, Wilson 1987b); *Geophis* (Downs 1967); *Gyalopion* (Hardy 1975a, 1976); *Haplocercus* (Wall 1921, Smith 1943, Deraniyagala 1955); *Homoroselaps* (Broadley 1983); *Hypoptophis* (Witte and Laurent 1947, Witte 1953); *Leptomicrurus* (Hoge and Romano 1966, Roze and Bernal-Carlo 1987); *Loveridgelaps* (McDowell 1970, McCoy 1980); *Lycodon* (Rooij 1917, Wall 1921, Smith 1943, Leviton 1965); *Lycophidion* (Laurent 1968, Broadley 1992, Broadley and Hughes 1993); *Macrelaps* (Witte and Laurent 1947, Broadley 1983); *Macrocalamus* (Boulenger 1912, Lim 1964, Grandison 1972, Tweedie 1983); *Maticora* (Taylor 1922, Bourret 1936, Brongersma 1948, Leviton 1964); *Micrelaps* (Witte and Laurent 1947, Pitman 1974); *Micropechis* (McDowell 1970); *Micruroides* (Wright and Wright 1957, Roze 1974, Campbell and Lamar 1989, Ernst 1992); *Micrurus* (Roze 1967, Campbell and Lamar 1989); *Myersophis* (Taylor 1963, Leviton 1983); *Ninia* (Burger and Werler 1954, Taylor 1954, Savage and Lahanas 1991); *Ogmodon* (McDowell 1969, 1970, Gorham 1970); *Oreocalamus* (Smith 1931, Tweedie 1983); *Oxyrhabdium* (Taylor 1922, Leviton 1965); *Paranaja* (Loveridge 1944, Laurent 1956); *Parapistocalamus* (Williams and Parker 1964, McDowell 1969, McCoy 1980); *Pararhadinaea* (Guibé 1959, Domergue 1984); *Plagiopholis* (Pope 1935, Smith 1943, Deuve 1970); *Platyplectrurus* (Smith 1943); *Poecilopholis* (Boulenger 1903); *Polemon* (Witte and Laurent 1947); *Prosymna* (Loveridge 1958, Broadley 1980); *Pseudoficimia* (Taylor and Smith 1942a, Hardy 1972, 1973); *Pseudorabdion* (Rooij 1917, Leviton and Brown 1959, Inger and Leviton 1966); *Rabdion* (Rooij 1917); *Rhabdops* (Pope 1935, Smith 1943); *Rhinoplocephalus* (Hoser 1989, Cogger 1992); *Salomonelaps* (McDowell 1970, McCoy 1980); *Simoselaps* (Storr 1968, Hoser 1989, Cogger 1992); *Stenorrhina* (Taylor 1941, 1951, Wilson and Meyer 1985); *Sulosoma* (Highton 1976, Ernst and Barbour 1989); *Suta* (Storr et al. 1986, Hoser 1989, Cogger 1992); *Tantilla* (Wilson and Mena 1980, Wilson and Meyer 1981, Wilson 1982, 1987a); *Tantillita* (Smith 1940); *Tetralepis* (Rooij 1917); *Toluca* (Taylor and Smith 1942b); *Toxicocalamus* (McDowell 1969); *Trachischium* (Smith 1943); *Vermicella* (Storr 1968, Gow 1989, Hoser 1989, Cogger 1992); *Virginia* (Blanchard 1923, Rossman and Wallach 1991); *Walterinnesia* (Marx 1953, Gasperetti 1988); *Xenocalamus* (Witte and Laurent 1947, Broadley 1971b); *Xenopeltis* (Mahendra 1938, Smith 1943, Hu et al. 1980, Leviton 1983); and *Xylophis* (Smith 1943).

onto dorsum of head, small eye, similar eye-snout ratio, two postoculars, temporal formula of 1 + 2 + 3, similar shape and arrangement of temporals, countersunk lower jaw, mental separated from pregenials by first infralabials, eight infralabials with first four contacting pregenials, similar ventral and subcaudal counts, single anal and paired subcaudals, short sharply-pointed tail, smooth glossy body scales, dark ventral coloration, and small body size. However, *Cryptophidion* differs from *Lycophidion* in prenasal separated from rostral, postnasal smaller than nostril, absence of the loreal, size of the preorbital, temporolabial shield, pregenials broader than infralabials, two pairs of greatly reduced postgenials, narrow ventrals, and absence of light wavy stripes on the head (Laurent 1968, Broadley 1992).

Among the Oxyuraninae (Table 4), *Simoselaps* is the most derived genus for a fossorial life and shares the depressed snout and pointed rostral with *Cryptophidion.* However, it differs from *Cryptophidion* in fewer supralabials and infralabials, nasal in contact with rostral, enlarged postgenials, and a divided anal. Within the Pacific region, only *Ogmodon* of the Parapistocalamini possesses a pointed rostrum as in *Cryptophidion,* but it is different from *Cryptophidion* in its nasal contacting rostral, fewer supralabials and infralabials, single small postocular, lack of anterior temporal, enlarged postgenials, divided anal, and light venter. *Cryptophidion* most closely resembles *Loveridgelaps* but differs in fewer ventrals, rostral shape, separation of nasal from rostral, greater number of supralabials and infralabials, reduced postgenials, and ventral coloration.

In the New World, a number of sharp-nosed burrowing radiations took place (Table 5). The xenodontine *Enulius* differs from *Cryptophidion* in its nasal contacting the rostral, presence of loreal, absence of preocular, divided anal, long tail with more than 80 subcaudals, and a light venter. *Apostolepis* of the Elapomorphini differs from *Cryptophidion* in number of supralabials, nasal in contact with rostral, absence of preocular, absence of anterior temporal and temporolabial, enlarged postgenials, divided anal, and ventral coloration. *Chilomeniscus, Conopsis, Ficimia, Geagras, Gyalopion, Pseudoficimia* and *Toluca* differ from *Cryptophidion* in the nasal contacting the rostral, fewer supralabials with third and fourth in orbit, divided anal plate, fewer ventrals, and light venter.

Within the New World, *Cryptophidion* most closely resembles *Atractus occipitoalbus* and *Emmochliophis* of Ecuador. *Cryptophidion* differs from *Atractus occipitoalbus* in depression of snout, laterally pointed rostrum, absence of a loreal, large postoculars, and small gulars. *Emmochliophis* differs from *Cryptophidion* in a blunt rostral, nasal in contact with rostral, fused prefrontals in contact with supralabials, superior borders of supralabials parallel to lip, low ventral count, very long tail with high number of subcaudals, enlarged postgenials, and ventral coloration.

Conclusion

Taxonomic characters that are not definitely known for *Cryptophidion* include the family allocation (presumed to be Colubridae), number of longitudinal scale rows (presumed to be about 15), posterior scale row reduction (presumed to be absent), carination of costals (presumed keelless), apical pits on costals (presumed absent), shape of pupil (presumed round), mental groove (presumed absent), dorsal coloration and pattern (presumed uniformly dark without pattern), total length (presumed to be less than 300 mm), and the shape and number of the dorsal head shields (presumed to possess the typical colubroid complement of nine shields, possibly with prefrontals or internasals fused).

A comparison of the data known for *Cryptophidion* with similar data for all possible snake genera reveals that not only is it unlike any Southeast Asian snake but it also does not appear to be closely related to any other known genus. Within Southeast Asia, it is unique in the presence of a sharply-pointed lateral head profile, due to the depressed snout and pointed rostral shield. Also peculiar and of uncertain homology are the two large diamond-shaped postoculars, shields that may in fact be temporals. Other unusual features of *Cryptophidion* are the concavity and extreme reduction in size of the nasal shields, the prenasal separated from the rostral, and a single pair of enlarged genials.

Cryptophidion combines several generalized features of a terrestrial snake (8 supralabials with a 3:2:3 pattern, and large diamond-shaped primary, secondary and tertiary temporals of equal size) with certain derived features characteristic of burrowing forms (pointed snout, narrow head, countersunk lower jaw, small eye, reduced nasals, separation of nasal from rostral, absence of loreal, enlarged pregenials, narrow ventrals, short tail, low subcaudal count, and smooth shiny scales) in addition to a unique feature (enlarged preorbital). It is a mysterious and perplexing animal, and private collectors and curators are urged to examine their Vietnamese material in search of the missing type or additional specimens. Until the type is rediscovered or another specimen is found and examined in detail, a complete description of the species and interpretation of its relationships must remain highly speculative.

It is concluded that the affinities of *Cryptophidion* are unknown at the present time. It is not closely related to any genus in Southeast Asia. Within the rest of the world, it is most similar to *Myersophis* of the Philippines, *Lycophidion* of Africa, and *Emmochliophis* of Ecuador.

The status of *Cryptophidion* in its native environment is unknown. Since it appears to be a fossorial taxon, it is not surprising that it has gone unnoticed by the scientific community until now. It may very well be abundant in the localities where it lives, but most likely it has a restricted distribution, and it may be endemic to central Vietnam and adjacent Laos. The fact that

other specimens have not been reported suggests that it may be a highland endemic, as lowland areas have been explored in greater detail than the highlands. The discovery of this unusual species with so many peculiar characteristics has raised more questions than it has answered, and additional specimens are badly needed in order to fully describe the organism and to understand its relationship to other snakes. Quite possibly it is the sole living relict of a previously abundant Southeast Asian line of burrowers. Biologists, conservationists, and amateur snake enthusiasts are urged to be on the lookout for any small burrowing snake with a pointed nose that fits the description of *Cryptophidion*. The photographic slides of *Cryptophidion* provide only a tantalizing taste of a main course hopefully yet to come.

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References Cited

Ahl, Ernst
1933 Ergebnisse der Celebes-und Halmaheira-Expedition Heinrich 1930–32. 1. Reptilien und Amphibien. *Mitteilungen aus dem Zoologischen Museum in Berlin,* Vol. 19: 577–583.

Banta, Benjamin H., and Alan E. Leviton
1963 Remarks on the Colubrid Genus *Chilomeniscus* (Serpentes: Colubridae). *Proceedings of the California Academy of Sciences,* Ser. 4, Vol. 31 (11): 309–327.

Blanchard, Frank N.
1923 The Snakes of the Genus Virginia. *Papers of the Michigan Academy of Sciences, Arts and Letters,* Vol. 3: 343–365.

Bogert, Charles M.
1940 Herpetological Results of the Vernay Angola Expedition. *Bulletin of the American Museum of Natural History,* Vol. 77 (1): 1–107.

Boulenger, George A.
1893 *Catalogue of Snakes in the Collection of the British Museum (Natural History).* Vol. I. London: British Museum (Natural History).
1894 *Catalogue of Snakes in the Collection of the British Museum (Natural History).* Vol. II. London: British Museum (Natural History).
1896 *Catalogue of Snakes in the Collection of the British Museum (Natural History).* Vol. III. London: British Museum (Natural History).
1898 An Account of the Reptiles and Batrachians Collected by Mr. W. F. H. Rosenberg in Western Ecuador. *Proceedings of the Zoological Society of London,* 1898: 107–126.
1903 Descriptions of New Snakes in the Collection of the British Museum. *Annals and Magazine of Natural History,* Ser. 7, Vol. 12 (69): 350–354.
1912 *A Vertebrate Fauna of the Malay Peninsula from the Isthmus of Kra to Singapore, Including the Adjacent Islands.* London: Taylor and Francis.

Bourret, René
1935 Notes Herpétologiques sur l'Indochine Française. VIII. Sur les *Achalinus* d'Indochine. *Bulletin Général de l'Instruction Publique,* 1935 (5, janvier): 101–104.
1936 *Les Serpents de l'Indochine. Tome II. Catalogue Systématique Descriptif.* Toulouse: Henri Basuyau.

Broadley, Donald G.
1968 The African Wolf Snakes (Serpentes, Colubridae): A New Genus and Species from Mozambique. *Arnoldia, Rhodesia,* Vol. 4 (10): 1–5.
1971a A Revision of the African Snake Genus *Elapsoidea* Bocage (Elapidae). *Occasional Papers of the National Museums of Rhodesia,* Ser. B, Vol. 4 (32): 577–626.
1971b A Revision of the African Snake Genera *Amblyodipsas* and *Xenocalamus. Occasional Papers of the National Museums of Rhodesia,* Ser. B, Vol. 4 (33): 629–697.
1980 A Revision of the African Snake Genus *Prosymna* Gray (Colubridae). *Occasional Papers of the National Museums and Monuments,* Ser. B, Vol. 6 (7): 483–556.
1983 *FitzSimons' Snakes of Southern Africa.* Johannesburg: Delta Books.
1991 A Review of the Southern African Stiletto Snakes of the Genus *Atractaspis* A. Smith (Serpentes: Atractaspididae). *Arnoldia, Zimbabwe,* Vol. 9 (36): 495–517.
1992 The Taxonomy and Zoogeography of the Genus *Lycophidion* (Serpentes: Colubridae). *Journal of the Herpetological Association of Africa,* Vol. 40: 30–36.

Broadley, Donald G., and Barry Hughes
1993 A Review of the Genus *Lycophidion* (Serpentes: Colubridae) in Northeastern Africa. *Herpetological Journal,* Vol. 3: 8–18.

Brongersma, L. D.
1934 Contributions to Indo-Australian Herpetology. *Zoologische Mededelingen,* Vol. 17: 161–251.
1948 Notes on *Maticora bivirgata* (Boie) and on *Bungarus flaviceps* Reinh. *Zoologische Mededelingen,* Vol. 30 (1): 1–29.

Burger, W. Leslie, and John E. Werler
1954 The Subspecies of the Ring-Necked Coffee Snake, *Ninia diademata* and a Short Biological and Taxonomic Account of the Genus. *University of Kansas Science Bulletin,* Vol. 36, Pt. 2 (10): 643–672.

Campbell, Jonathan A., and William W. Lamar
1989 *The Venomous Reptiles of Latin America.* Ithaca: Comstock Publishing.

Campbell, Jonathan A., and Linda S. Ford
1982 Phylogenetic Relationships of the Colubrid Snakes of the Genus *Adelphicos* in the Highlands of Middle America. *Occasional Papers of the Museum of Natural History, University of Kansas,* Vol. 100: 1–22.

Campden-Main, Simon M.
1970 *A Field Guide to the Snakes of South Vietnam.* Washington: U.S. National Museum.

Capocaccia, Lilia

1976 Contributo allo Studio dei Serpenti dell'Isola di Giava. *Annali del Museo Civico di Storia Naturali di Genova,* Vol. 81: 51–95.

Clark, Donald R., Jr.
1970 Ecological Study of the Worm Snake *Carphophis vermis* (Kennicott). *University of Kansas Publications, Museum of Natural History,* Vol. 19 (2): 85–194.

Cogger, Harold G.
1992 *Reptiles and Amphibians of Australia.* 5th ed. Ithaca: Cornell University Press.

Cope, Edward D.
1900 The Crocodilians, Lizards and Snakes of North America. *Annual Report of the Board of Regents of the Smithsonian Institution* (1898): 155–1294.

Cox, Merel J.
1991 *The Snakes of Thailand and their Husbandry.* Malabar: Robert E. Krieger.

Deraniyagala, P. E. P.
1955 *A Colored Atlas of Some Vertebrates from Ceylon. Volume 3. Serpentoid Reptilia.* Colombo: Colombo National Museum.

Dethier, Michel, and Ayako Dethier-Sakamoto
1987 The *tzuchinoko,* an Unidentified Snake from Japan. *Cryptozoology,* Vol. 6: 40–48.

Deuve, J.
1970 Serpents du Laos. *Mémoire du l'Office de la Recherche Scientifique et Technique Outre-Mer,* Vol. 39: 1–251.

Dixon, James R., and Pekka Soini
1986 *The Reptiles of the Upper Amazon Basin, Iquitos Region, Peru. Part I: Lizards and Amphisbaenians. Part II: Crocodilians, Turtles and Snakes.* Milwaukee: Milwaukee Public Museum.

Domergue, Charles A.
1984 Notes sur les Serpents de la Région Malgache. IV. Le genre *Pararhadinaea* Boettger, 1898. Descriptions d'une Espèce et d'une Sous-Espèce Nouvelles. *Bulletin du Muséum National d'Histoire Naturelle,* Sér. 4, Sect. A, Vol. 6 (1): 149–157.

Dowling, Herndon G., and William E. Duellman
1978 *Systematic Herpetology: A Synopsis of Families and Higher Categories.* New York: Herpetological Information and Search Service.

Downs, Floyd L.
1967 Intrageneric Relationships among Colubrid Snakes of the Genus *Geophis* Wagler. *Miscellaneous Publications, Museum of Zoology, University of Michigan,* Vol. 131: 1–193.

Dung, Vu Van, Pham Mong Giao, Nguyen Ngoc Chinh, Do Tuoc, Peter Arctander, and John MacKinnon
1993 A New Species of Living Bovid from Vietnam. *Nature,* Vol. 363 (6428): 443–445.

Ernst, Carl H.
1992 *Venomous Reptiles of North America.* Washington: Smithsonian Institution Press.

Ernst, Carl H., and Roger W. Barbour
1989 *Snakes of Eastern North America.* Fairfax: George Mason University Press.

Fritts, Thomas H., and Hobart M. Smith
1969 A New Genus and Species of Snake from Western Ecuador. *Transactions of the Kansas Academy of Science,* Vol. 72 (1): 60–66.

Frizzell, Donald L.
1933 Terminology of Types. *American Midland Naturalist,* Vol. 14 (6): 637–668.

Gans, Carl, and Joseph R. Fetcho
1982 The Sri Lankan Genus *Aspidura* (Serpentes, Reptilia, Colubridae). *Annals of Carnegie Museum,* Vol. 51 (14): 271–316.

Gasperetti, John
1988 Snakes of Arabia. *In*: W. Büttiker and F. Krupp (eds.). *Fauna of Saudi Arabia.* Vol. 9. Riyadh: National Commission for Wildlife Conservation and Development.

Gorham, Stanley W.
1970 The Rare Fiji Snake *Ogmodon vitianus* Peters. *Agricultural Journal* (Fiji), Vol. 32: 49–51.
Gow, Graeme F.
1989 *Graeme Gow's Complete Guide to Australian Snakes.* North Ryde: Angus & Robertson.
Grandison, Alice G. C.
1972 The Gunong Benom Expedition, 1967 (5). Reptiles and Amphibians of Gunong Benom with a Description of a New Species of *Macrocalamus. Bulletin of the British Museum (Natural History), Zoology,* Vol. 23 (4): 43–101.
Greenwell, J. Richard
1985 A Classificatory System for Cryptozoology. *Cryptozoology,* Vol. 4: 1–14.
Guibé, Jean-Claude
1959 Les Serpents de Madagascar. *Mémoires de l'Institut Scientifique de Madagascar, Biologie Animale* (1958), Sér. A, Vol. 12: 189–260.
Hardy, Laurence M.
1972 A Systematic Revision of the Genus *Pseudoficimia* (Serpentes: Colubridae). *Journal of Herpetology,* Vol. 6 (1): 53–69.
1973 Reptilia: Squamata: Serpentes: Colubridae: *Pseudoficimia. Catalogue of American Amphibians and Reptiles* (pp. 146.1–146.2).
1975a A Systematic Revision of the Colubrid Snake Genus *Gyalopion. Journal of Herpetology,* Vol. 9 (1): 107–132.
1975b A Systematic Revision of the Colubrid Snake Genus *Ficimia. Journal of Herpetology,* Vol. 9 (2): 133–168.
1976 Reptilia: Squamata: Serpentes: Colubridae: *Gyalopion. Catalogue of American Amphibians and Reptiles* (pp. 182.1–182.4).
1990 Reptilia: Squamata: Serpentes: Colubridae: *Ficimia. Catalogue of American Amphibians and Reptiles* (pp. 471.1–471.5).
Heuvelmans, Bernard
1982 What is Cryptozoology? *Cryptozoology,* Vol. 1: 1–12.
1984 The Birth and Early History of Cryptozoology. *Cryptozoology,* Vol. 3: 1–30.
1986 Annotated Checklist of Apparently Unknown Animals with which Cryptozoology is Concerned. *Cryptozoology,* Vol. 5: 1–26.
Highton, Richard
1976 Reptilia: Squamata: Serpentes: Colubridae: *Stilosoma. Catalogue of American Amphibians and Reptiles* (pp. 183.1–183.2).
Hillis, David M.
1990 A New Species of Xenodontine Colubrid Snake of the Genus *Synophis* from Ecuador and the Phylogeny of the Genera *Synophis* and *Emmochliophis. Occasional Papers of the Museum of Natural History, University of Kansas,* Vol. 135: 1–9.
Hoge, Alphonse R., and Sylvia A. R. W. D. L. Romano
1966 *Leptomicrurus* in Brasil [Serpentes—Elapidae]. *Memórias do Instituto Butantan* (1965), Vol. 32: 1–8.
Hoogmoed, Marinus S.
1980 Notes on the Herpetofauna of Surinam VII. Revision of the Genus *Atractus* in Surinam, with the Resurrection of Two Species (Colubridae, Reptilia). *Zoologische Verhandelingen,* Vol. 175: 1–47.
Hoser, Raymond T.
1989 Australian Reptiles and Frogs. Sydney: Pierson.
Hu, Bu-Ching, Mai-Hua Huang, Zhan-Tai Xie, Er-Mi Zhao, Yao-Ming Jiang, and Chin-Yuan Huang
1980 *Atlas of the Snakes of China.* Shanghai: Science and Technology Press. (In Chinese.)
Hutchinson, Mark N.

1990 The Generic Classification of the Australian Terrestrial Elapid Snakes. *Memoirs of the Queensland Museum,* Vol. 29 (2): 397–405.
Inger, Robert F., and Alan E. Leviton
1966 The Taxonomic Status of Bornean Snakes of the Genus *Pseudorabdion* Jan and of the Nominal Genus *Idiopholis* Mocquard. *Proceedings of the California Academy of Sciences,* Vol. 34 (4): 307–314.
Inger, Robert F., and Hymen Marx
1965 The Systematics and Evolution of the Oriental Colubrid Snakes of the Genus *Calamaria. Fieldiana, Zoology,* Vol. 49: 1–304.
International Commission on Zoological Nomenclature
1985 *International Code of Zoological Nomenclature, Adopted by the XX General Assembly of the International Union of Biological Sciences.* 3rd edition. London: International Trust for Zoological Nomenclature.
Kluge, Arnold G.
1991 Boine Snake Phylogeny and Research Cycles. *Miscellaneous Publications, Museum of Zoology, University of Michigan,* Vol. 178: 1–58.
1993 *Aspidites* and the Phylogeny of Pythonine Snakes. *Records of the Australian Museum,* Suppl. 19: 1–77.
Lanza, Benedetto
1966 Il Genere *Brachyophis* e Descrizione di una Nuova Forma (Reptilia, Serpentes, Colubridae). *Monitore Zoologico Italiano,* Vol. 74 (1–3): 30–48.
Laurent, Raymond F.
1945 Contribution à la Connaissance du Genre *Atractaspis* Smith. *Revue de Zoologie et Botanie Africaine,* Vol. 38 (3–4): 312–343.
1950 Revision du Genre *Atractaspis.* A. Smith. *Mémoires du Institut Royal des Sciences Naturelles de Belgique,* Sér. 2, Vol. 38: 1–49.
1956 Contribution à l'Herpétologie de la Région des Grands Lacs de l'Afrique Centrale. I. Généralités. II. Chéloniens. III. Ophidiens. *Annales du Musée Royal du Congo Belge, Sciences Zoologiques,* Sér. 8°, Vol. 48: 1–390.
1968 A Re-Examination of the Snake Genus *Lycophidion* Duméril and Bibron. *Bulletin of the Museum of Comparative Zoology,* Vol. 136 (12): 461–482.
Lema, Thales de
1978 Novas Espécies de Opistoglifontes do Gênero *Apostolepis* Cope 1861 do Paraguai (Ophidia: Colubridae). *Comunicações do Museu de Ciências da Pontifícia Universidade Católica do Rio Grande do Sul,* Vol. 18–19: 1–49.
1979 *Elapomorphus punctatus,* Nova Espécie de Colubridae para a Argentina (Ophidia). *Revista Brasileira de Biologia,* Vol. 39 (4): 835–853.
1984 Sobre o Gênero *Elapomorphus* Wiegmann, 1843 (Serpentes, Colubridae, Elapomorphinae). *Iheringia, Zoologia,* Vol. 64: 53–86.
1993 Polimorfismo em *Apostolepis dimidiata* (Jan, 1862) com a Invalidação de *Apostolepis villaricae* Lema, 1978 e *Apostolepis barrioi* Lema, 1978 (Serpentes: Colubridae: Xenodontinae: Elapomorphini). *Acta Biologica Leopoldensia,* Vol. 15 (1): 35–52.
Leviton, Alan E.
1964 Contributions to a Review of Philippine Snakes, III. The Genera *Maticora* and *Calliophis. Philippine Journal of Science* (1963), Vol. 92 (4): 523–550.
1965 Contributions to a Review of Philippine Snakes, VI. The Snakes of the Genus *Oxyrhabdium. Philippine Journal of Science* (1964), Vol. 93 (3): 407–422.
1983 Contribution to a Review of Philippine Snakes, XIV. The Snakes of the Genera *Xenopeltis, Zaocys, Psammodynastes* and *Myersophis. Philippine Journal of Science,* Vol. 112 (3–4): 195–223.
Leviton, Alan E., and Walter C. Brown
1959 A Review of the Snakes of the Genus *Pseudorabdion* with Remarks on the Status of

the Genera *Agrophis* and *Typhlogeophis* (Serpentes: Colubridae). *Proceedings of the California Academy of Sciences,* Vol. 29 (14): 475–508.

Lim, Boo Liat
1964 *Macrocalamus tweediei,* a New Species of Reed Snake from Malaya. *Bulletin of the National Museum, Singapore* (1963), Vol. 32: 99–102.

Loveridge, Arthur
1944 Further Revisions of African Snake Genera. *Bulletin of the Museum of Comparative Zoology,* Vol. 95 (2): 121–247.
1958 Revision of Five African Snake Genera. *Bulletin of the Museum of Comparative Zoology,* Vol. 119 (1): 1–198.

Mahendra, Beni C.
1936 On Two Collections of the Ophidian Genus *Cylindrophis* Wagler. *Proceedings of the Indian Academy of Sciences,* Ser. B, Vol. 4 (3): 230–238.
1938 The Lepidosis of *Xenopeltis unicolor* Reinw. *Current Science,* Vol. 6 (11): 559–560.

Maki, Moichiro
1931 *A Monograph of the Snakes of Japan.* Tokyo: Dai-ichi Shobo.

Marx, Hymen
1953 The Elapid Genus of Snakes, *Walterinnesia. Fieldiana, Zoology,* Vol. 34 (16): 189–196.

Marx, Hymen, and Robert F. Inger
1955 Notes on Snakes of the Genus *Calamaria. Fieldiana, Zoology,* Vol. 37: 167–209.

Marx, Hymen, and George B. Rabb
1972 Phyletic Analysis of Fifty Characters of Advanced Snakes. *Fieldiana, Zoology,* Vol. 63: 1–321.

McCoy, Michael
1980 Reptiles of the Solomon Islands. *Wau Ecology Institute Handbook,* Vol. 7: 1–80.

McDowell, Samuel B., Jr.
1967 *Aspidomorphus,* a Genus of New Guinea Snakes of the Family Elapidae, with Notes on Related Genera. *Journal of Zoology,* Vol. 151: 497–543.
1969 *Toxicocalamus,* a New Guinea Genus of Snakes of the Family Elapidae. *Journal of Zoology,* Vol. 159: 443–5 11.
1970 On the Status and Relationships of the Solomon Island Elapid Snakes. *Journal of Zoology,* Vol. 161: 145–190.
1975 A Catalogue of the Snakes of New Guinea and the Solomons, with Special Reference to Those in the Bernice P. Bishop Museum, Part II. *Journal of Herpetology,* Vol. 9 (1): 1–79.
1979 A Catalogue of the Snakes of New Guinea and the Solomons, with Special Reference to Those in the Bernice P. Bishop Museum, Part III. *Journal of Herpetology,* Vol. 13 (1): 1–92.
1987 Systematics. *In*: Richard A. Seigel, Joseph T. Collins, and Susan S. Novak (eds.). *Snakes: Ecology and Evolutionary Biology.* New York: McGraw-Hill.

Mertens, Robert
1930 Die Amphibien und Reptilien der Inseln Bali, Lombok, Sumbawa und Flores (Beiträge zur Fauna der Kleinen Sunda-Inseln, I). *Abhandlungen der Senckenbergischen Naturforschenden Gesellschaft,* Vol. 42 (3): 115–344.

Mitchell, Joseph C.
1982 Reptilia: Squamata: Serpentes: Colubridae: *Farancia. Catalogue of American Amphibians and Reptiles* (pp. 292.1–292.2).

Nutphand, Wirot, and Bunyuen Tumvipart
1982 *The Treatment of Poisonous Snakebite Victims and the Venomous Snakes of Thailand.* Bangkok. (In Thai.)

Ota, Hidetoshi, and Masanao Toyama
1989 Taxonomic Re-Definition of *Achalinus formosanus* Boulenger (Xenoderminae: Colubridae: Ophidia), with Description of a New Subspecies. *Copeia,* 1989 (3): 597–602.

Peters, James A.
1964 *Dictionary of Herpetology. A Brief and Meaningful Definition of Words and Terms Used in Herpetology.* New York: Hafner.

Pitman, Charles R. S.
1974 *A Guide to the Snakes of Uganda.* 2nd ed. Codicote: Wheldon and Wesley.

Pope, Clifford H.
1935 *The Reptiles of China: Turtles, Crocodilians, Snakes, Lizards.* New York: American Museum of Natural History.

Rabb, George B., and Hymen Marx
1973 Major Ecological and Geographic Patterns in the Evolution of Colubroid Snakes. *Evolution,* Vol. 27 (1): 69–83.

Rooij, Nelly de
1917 *The Reptiles of the Indo-Australian Archipelago. II. Ophidia.* Leiden: E. J. Brill.

Rossman, Douglas A., and Van Wallach
1991 Reptilia: Squamata: Serpentes: Colubridae: *Virginia. Catalogue of American Amphibians and Reptiles* (pp. 529.1–529.4).

Roze, Janis A.
1967 A Check List of the New World Venomous Coral Snakes (Elapidae), with Descriptions of New Forms. *American Museum Novitates,* Vol. 2287: 1–60.
1974 Reptilia: Squamata: Serpentes: Colubridae: *Micruroides, M. euryxanthus.* Catalogue of American Amphibians and Reptiles (pp. 163.1–163.4.)

Roze, Janis A., and A. Bernarl-Carlo
1987 Las Serpientes Corales Venenosas del Género *Leptomicrurus* (Serpentes, Elapidae) de Suramérica con Descripción de una Nueva Subespecie. *Bollettino del Museo Regionale di Scienze Naturali,* Vol. 5 (2): 573–608.

Saint-Girons, Hubert
1972 Les Serpents du Cambodge. *Mémoires du Muséum National d'Histoire Naturelle, Zoologie,* Sér. 2, Vol. 74: 1–170.

Savage, Jay M.
1960 A Revision of the Ecuadorian Snakes of the Colubrid Genus *Atractus. Miscellaneous Publications, Museum of Zoology, University of Michigan,* Vol. 112: 1–86.

Savage, Jay M., and Pete N. Lahanas
1991 On the Species of the Colubrid Snake Genus *Ninia* in Costa Rica and Western Panama. *Herpetologica,* Vol. 47 (1): 37–53.

Smedley, Norman
1932 Amphibians and Reptiles from the Cameron Highlands, Malay Peninsula. *Bulletin of the Raffles Museum, Straits Settlements* (1931), Vol. 6: 105–123.

Smith, Hobart M.
1940 Descriptions of New Lizards and Snakes from Mexico and Guatemala. *Proceedings of the Biological Society of Washington,* Vol. 53: 55–64.
1942 A Review of the Snake Genus *Adelphicos. Proceedings of the Rochester Academy of Sciences,* Vol. 8: 175–195.

Smith, Hobart M., and Edward H. Taylor
1940 A Review of the Snakes of the Genus *Ficimia. Journal of the Washington Academy of Sciences,* Vol. 31 (8): 356–368.

Smith, Hobart M., Rozella B. Smith, and H. Lewis Sawin

1977 A Summary of Snake Classification (Reptilia, Serpentes). *Journal of Herpetology,* Vol. 11 (2): 115–121.

Smith, Malcolm A.
1931 The Herpetology of Mt. Kinabalu, North Borneo, 13,455 ft. *Bulletin of the Raffles Museum, Straits Settlements,* Vol. 5: 3–33.
1943 *The Fauna of British India, Ceylon and Burma, Including the Whole of the Indo-Chinese Sub-Region. Reptilia and Amphibia. Vol. III. Serpentes.* London: Taylor and Francis.

Stone, Richard
1992 No Ordinary Ungulate. (Random Samples coloumn.) *Science,* Vol. 257 (5071): 742.

Storr, Glen M.
1968 The Genus *Vermicella* (Serpentes, Elapidae) in Western Australia and the Northern Territory. *Journal of the Royal Society of Western Australia* (1967), Vol. 50 (3): 80–92.

Storr, Glen M., L. A. Smith, and R. E. Johnstone
1986 *Snakes of Western Australia.* Perth: Western Australian Museum.

Strauch, Alexander A.
1885 Bemerkungen ber die Schlangengattung Elapomorphus aus der Familie der Calamariden. *Bulletin de l'Acadéie Impéial des Sciences de St. Pétersbourg* (1884), Vol. 29: 541–590.

Tanner, Wilmer W.
1961 A New Subspecies of *Conopsis nasus* from Chihuahua, Mexico. *Herpetologica,* Vol. 17 (1): 13–18.

Taylor, Edward H.
1922 *The Snakes of the Philippine Islands.* Manila: National Institue of Science and Technology.
1941 Herpetological Miscellany, No. II. *University of Kansas Science Bulletin,* Vol. 27, Pt. 1 (7): 105–138.
1949 A Preliminary Account of the Herpetology of the State of San Luis Potosí, Mexico. *University of Kansas Science Bulletin,* Vol. 33, Pt. 1 (2): 169–215.
1951 A Brief Review of the Snakes of Costa Rica. *University of Kansas Science Bulletin,* Vol. 34, Pt. 2 (1): 1–188.
1954 Further Studies on the Serpents of Costa Rica. *University of Kansas Science Bulletin,* Vol. 36, Pt. 2 (11): 673–801.
1963 New and Rare Oriental Serpents. *Copeia,* 1963 (2): 429–433.
1965 The Serpents of Thailand and Adjacent Waters. *University of Kansas Science Bulletin,* Vol. 45 (9): 609–1096.

Taylor, Edward H., and Hobart M. Smith
1942a Concerning the Snake Genus *Pseudoficimia. University of Kansas Science Bulletin,* Vol. 28, Pt. 2 (12): 241–251.
1942b The Snake Genera *Conopsis* and *Toluca. University of Kansas Science Bulletin,* Vol. 28, Pt. 2 (15): 325–363.

Tweedie, M. W. F.
1983 *The Snakes of Malaya.* 3rd ed. Singapore: Singapore National Printers.

Underwood, Garth
1967 *A Contribution to the Classification of Snakes.* London: British Museum (Natural History).
1979 Classification and Distribution of Venomous Snakes in the World. *In*: Chen-Yuan Lee (ed.). *Handbook of Experimental Pharmacology. Snake Venoms.* Berlin: Springer-Verlag. Vol. 52: 15–40.

Underwood, Garth, and Elazar Kochva
1993 On the Affinities of the Burrowing Asps *Atractaspis* (Serpentes: Atractaspididae). *Zoological Journal of the Linnean Society,* Vol. 107 (1): 3–64.

Wall, Frank
1921 *Ophidia Taprobanica or the Snakes of Ceylon.* Colombo: H. R. Cottle.

Wallach, Van
1985 A Cladistic Analysis of the Terrestrial Australian Elapidae. *In*: Gordon Grigg, Richard Shine, and Harry Ehmann (eds.). *Biology of Australasian Frogs and Reptiles.* Chipping Norton: Royal Zoological Society of New South Wales.
1988 Status and Redescription of the Genus *Padangia* Werner, with Comparative Visceral Data on *Collorhabdium* Smedley and other Genera (Serpentes: Colubridae). *Amphibia-Reptilia,* Vol. 9 (1): 61–76.
1991 *Comparative Visceral Topography of African Colubrid Snakes of the Subfamilies Aparallactinae and Atractaspidinae.* Master's thesis, Louisiana State University, Baton Rouge.

Williams, Ernest E., and Fred Parker
1964 The Snake Genus *Parapistocalamus* on Bougainville, Solomon Islands. *Senckenbergiana Biologica,* Vol. 45 (3–5): 543–552.

Williams, Kenneth L., and Van Wallach
1989 *Snakes of the World. Volume I. Synopsis of Snake Generic Names.* Malabar, Florida: Robert E. Krieger.

Wilson, Larry D.
1982a A Review of the Colubrid Snakes of the Genus *Tantilla* of Central America. *Milwaukee Public Museum Contributions in Biology and Geology,* Vol. 52: 1–77.
1982b Reptilia: Squamata: Serpentes: Colubridae: *Tantilla. Catalogue of American Amphibians and Reptiles* (pp. 307.1–307.4).
1987a A Résumé of the Colubrid Snakes of the Genus *Tantilla* of South America. *Milwaukee Public Museum Contributions in Biology and Geology,* Vol. 68: 1–35.
1987b Squamata: Serpentes: Colubridae: *Geagras, G. redimitus. Catalogue of American Amphibians and Reptiles* (pp. 430.1–430.2).

Wilson, Larry D., and Cesar E. Mena
1980 Systematics of the *melanocephala* Group of the Colubrid Snake Genus *Tantilla. San Diego Society of Natural History Memoir,* Vol. 11: 1–58.

Wilson, Larry D., and John R. Meyer
1981 Systematics of the *Calamarina* Group of the Colubrid Snake Genus *Tantilla. Milwaukee Public Museum Contributions in Biology and Geology,* Vol. 42: 1–25.
1985 *The Snakes of Honduras.* 2nd ed. Milwaukee: Milwaukee Public Museum.

Witte, Gaston-François de
1953 *Exploration du Parc National de l'Upemba. Fascicule 6. Reptiles.* Bruxelles: Institut des Parcs Nationaux du Congo Belge.
1962 Genera des Serpents du Congo et du Ruanda-Urundi. *Annales du Musée Royal de l'Afrique Centrale, Sciences Zoologiques,* Sér. 8° Vol. 104: 1–203.
1963 The Colubrid Snake Genera *Chamaelycus* Boulenger and *Oophilositum* Parker. *Copeia,* 1963 (4): 634–636.

Witte, Gaston-François de, and Raymond F. Laurent
1947 Révision d'un Groupe de Colubridae Africains. Genres *Calamelaps, Miodon, Aparallactus* et Formes Affines. *Mémoires du Musée Royal d'Histoire Naturelle de Belgique,* Sér. 2, Vol. 29: 1–134.

Wright, Albert W., and Anna A. Wright
1957 *Handbook of Snakes of the United States and Canada.* 2 vols. Ithaca: Comstock Publishing.

Zug, George R.
1993 *Herpetology. An Introductory Biology of Amphibians and Reptiles.* San Diego: Academic Press.